MEMOIR,

DESCRIPTIVE AND EXPLANATORY,

TO ACCOMPANY THE CHARTS

OF THE

NORTHERN

ATLANTIC OCEAN;

AND COMPRISING

INSTRUCTIONS, GENERAL AND PARTICULAR,

FOR THE

Navigation of that Sea.

TENTH EDITION,

CORRECTED AND MATERIALLY IMPROVED FROM MANY ORIGINAL COMMUNICATIONS.

PUBLISHED BY R. H. LAURIE,

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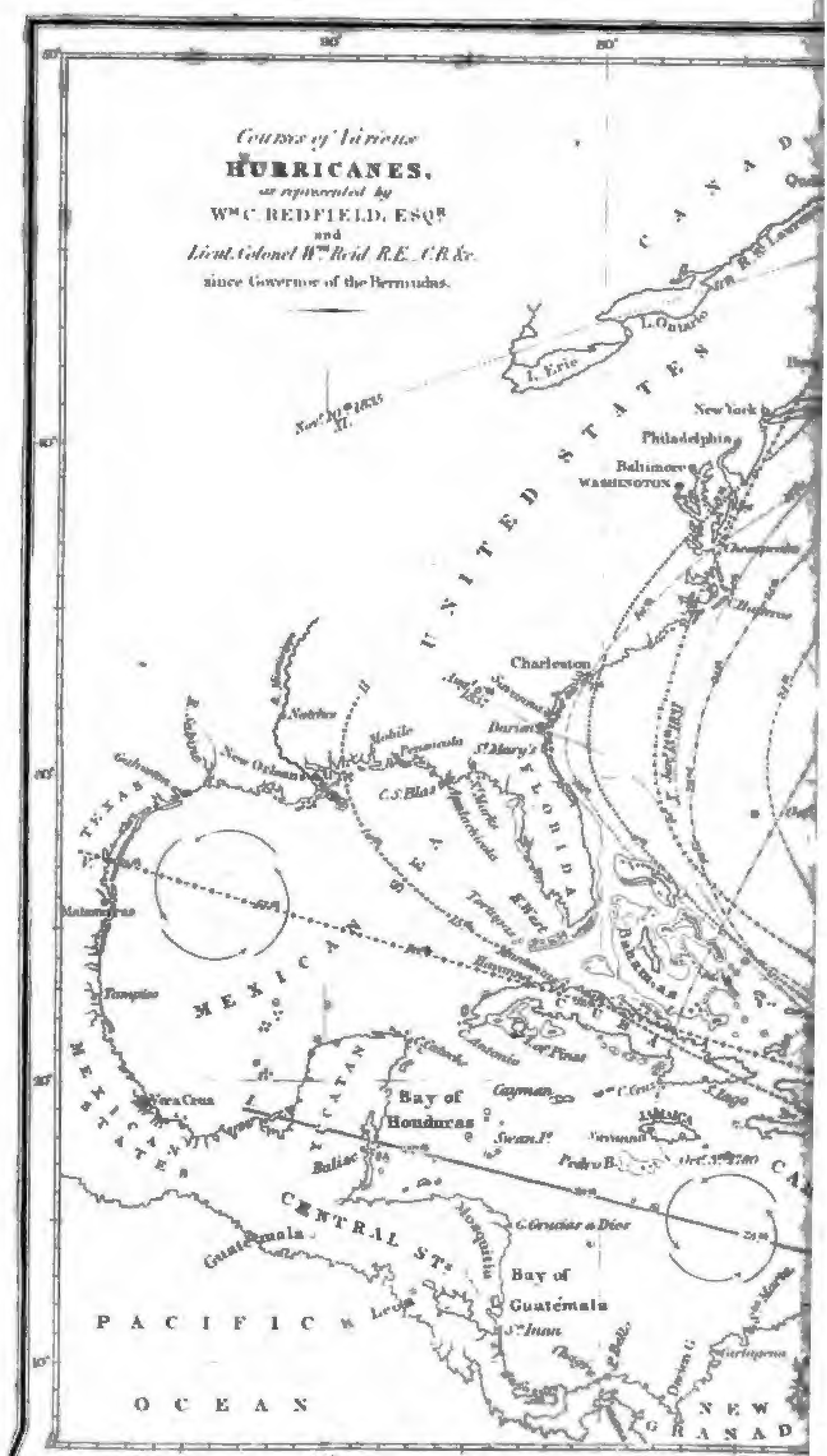

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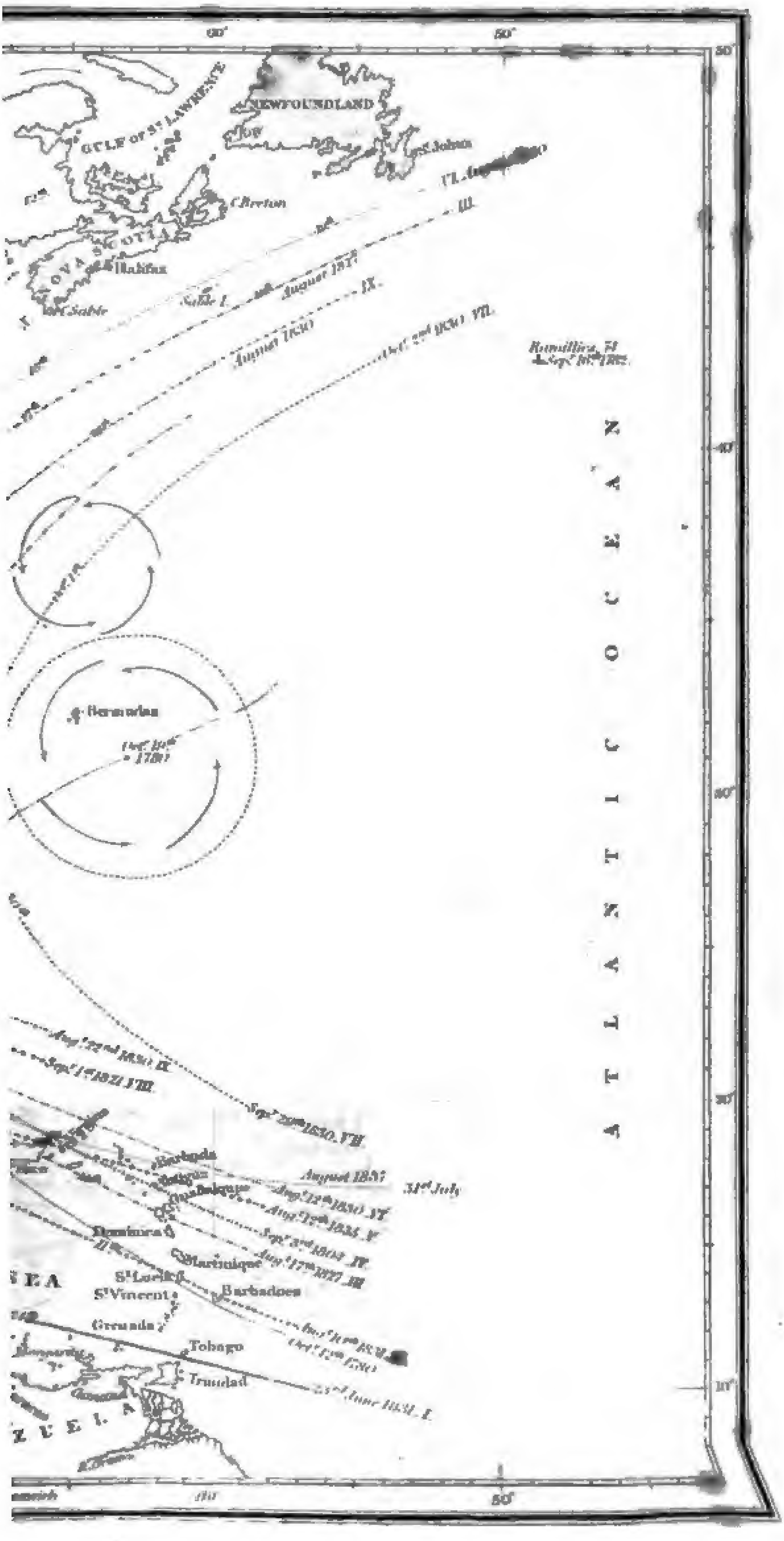

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Navigation of that Sea.

By JOHN PURDY, Hydrographer.

TENTH EDITION; CORRECTED AND MATERIALLY IMPROVED, FROM MANY ORIGINAL COMMUNICATIONS,

By ALEX. G. FINDLAY,

MEMBER OF THE ROYAL GEOGRAPHICAL SOCIETY.

LONDON:

PRINTED FOR R. H. LAURIE,

CHART-SELLER TO THE ADMIRALTY, THE HON. CORPORATION OF TRINITY-HOUSE, ETC.

No. 53, FLEET STREET.

1853.

"O'er the glad waters of the dark blue Sea,
Our thoughts as boundless, and our souls as free,
Far as the breeze can bear, the billows foam,
Survey our Empire, and behold our Home."

(*Lord Byron.*)

Printed by J. & W. Rider, 14, Bartholomew Close, London.

ADDRESS.

THIS work is designed to impart to the Navigator the MEANS of SAFETY over the ATLANTIC; to develop the silent and imperceptible CAUSES of ERROR and SHIPWRECK; to point out the BEST ROUTES to the numerous Ports of this Ocean; and to communicate useful Hints on GENERAL NAUTICAL PRACTICE.

Seven editions have already been honoured by the public approbation; and, stimulated by such encouragement, no attention has been spared in rendering an Eighth still more worthy of acceptance.

A comparison of the latter editions with those that preceded them, will show how much we have been indebted to numerous friends for recent and important information. We have had, again and again, to thank CAPTAIN LIVINGSTON, of Liverpool, for his numerous and valuable communications. In like manner have we been indebted to LIEUTENANT JOHN EVANS (*a*), R.N., and to Mr. EDWARD DUNSTERVILLE, whose information more fully appears in another work.*

To the subject of Currents, in particular, it will be found that our attention has been directed. These currents have at length excited that inquiry into their nature and causes which the importance of the subject demands. This has been especially evinced by the curious and elaborate work composed by the late MAJOR RENNELL, which has confirmed, generally, all that we had previously stated, and has, moreover, explained several essential particulars before unknown. Further investigations have been promised; so that we may expect, ultimately, an accurate view of all the *Atlantic Currents*, as they predominate in the different seasons.

We enlarge the more especially upon the Currents, because, as now treated on, they are to seamen almost a NEW SUBJECT. To the majority it is, at least, one on which they particularly require information. If this position be doubted, consult the melancholy events produced by them, which are described in the present volume, and take into consideration the incomparable number of similar cases which must necessarily

* "THE COLOMBIAN NAVIGATOR," Editions of 1839.

have escaped our notice; and of which many have been the indubitable effects of a confidence arising from *ignorance* and self-conceit.*

In presenting the former *Edition*, we had to return our thanks, for their valuable communications, to *John Mackellar*, Esq., since Rear-Admiral of the White; and to the Mercantile Captains, *James Wallace Monteath*, of Liverpool; *John Wilson* and *Thomas Hamlin*, of Greenock; *Wm. J. Capes*, then of the *Lady Mackworth; John Steele Park*, of the *Carshalton Park;* and *Thos. Wilson*, of the *Henry Wellesley*. To several of these gentlemen, to the late Captain *Midgley*, and to Captain *George Cheveley*, we have *again* been obliged for important and valuable additions, now incorporated in the work.

To Lieutenant *Charles Hare*, R.N., we are indebted for the route described by him for ships bound to New Brunswick, &c., in the succeeding pages 295, 296. This route is so evidently and greatly advantageous, to every commander and merchant in that trade, as to demand particular notice. To the friendship of Mr. *Wm. Heron*, of Greenock (since deceased), we have been indebted for several matters of importance; among which will be found some explanation of the currents about the southern coast of Newfoundland; currents which, *while unknown*, have probably been the cause of so many wrecks on that coast.

The important communications of an accomplished officer, *Lieutenant Greevelink*, late of the Dutch Royal Navy, which have added so considerably to a due knowledge of the West Indian Seas, have been incorporated and acknowledged in the *Colombian Navigator;* and so much of a general nature, as the subject required, has been re-introduced in the present volume.

In the Tables of Positions and Sailing Directions, many additions have been made from the Observations and Surveys of the officers

* The numerous wrecks that formerly occurred on the rocks and islands of Scilly, from ignorance of the tides and currents, are notorious. Add to these the wrecks, still more numerous, which have occurred on the coasts of Spain, Portugal, and Africa; upon which side of the ocean the currents have uniformly produced more mischief than on the opposite coasts. Among these were the British frigate *Apollo*, and about forty ships under her convoy, on the coast of Portugal, as described hereafter, p. 198; of the vessel with M. de Brisson, in 1787, on the coast upon which, in 1810, the American ship *Charles* was wrecked, as noticed and described in a succeeding page (337); of the *Montezuma*, page 202, of the *Eliza* and *Olymphe*, both in 1827, page 203; of the brig *Commerce*, page 338; of the *Oswego*, page 340; and *Medusa*, page 342; about thirty other vessels lost on the African coast, of which, according to the respectable authority of Mr. Jackson, about seventeen were English, and five American, page 336; twenty-six others wrecked on the Bar of Senegal, at different times, according to M. Golbery, page 353.

Many ships, also, have been lost, by the currents, &c., on Allegranza, Graciosa, and Santa Clara, of the Canaries; the *Hartwell*, East Indiaman, on the reefs of Bonavista, page 454; the *Cynthia*, *George*, *Cora*, &c., on the South shore of Barbadoes, page 215; and, by similar causes, several others, on the Roccas, &c., off the Brasilian coast. Many are recorded as being wrecked about Newfoundland, including the *Tweed*, the *Comus*, the *Harpooner*, the *Drake*, and the *Spence*; and to these may be added the *Lady Sherbrooke*, from Londonderry to the *River St. Lawrence, lost near* Port-au-Basque, East of Cape Race, Newfoundland, in July, 1831, *when 300 persons perished!*

Ethiopic or Southern Atlantic Ocean, may be considered as a continuation of the present work. It describes, in a similar manner, the Islands and Dangers of that Ocean, the Coast of Africa from Sherboro' Island to the Cape of Good Hope and Algoa Bay, and the Coasts of Brasil, &c., from the River Maranon Southward, to Cape Horn, including the Falkland Islands, South Shetland, &c.

The First Edition of this work appeared, without preface or apology, in the year 1812; a second was soon required, and, during the lifetime of its original composer, *eight* editions were called for, to the last of which the foregoing preface was affixed.

Before submitting a Ninth to public notice, the present Editor felt some diffidence in attempting to improve that which had employed so much of the time and talent of the late Mr. Purdy; but, as Hydrography, and the many branches of science therewith connected, are continually receiving fresh accessions, from the zeal and activity of the numerous observers that are at present labouring in the wide field of research, some revision was rendered absolutely necessary.

In the performance of this task, many redundances were to be removed, many important points to be dilated on. It is hoped that no source of authentic information has been overlooked, and that the work, as it is, offers a correct picture of the state of our Hydrographical knowledge at the present time.

Our thanks are due to many kind contributors, whose names and observations are recorded throughout the work, and we here tender them our acknowledgments.

This, the Tenth Edition, has been carefully revised throughout, and the various changes in the Hydrography of the Atlantic have been duly noticed.

London, January, 1853.

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APPENDIX;

CONTAINING HINTS AND REMARKS ON GENERAL NAUTICAL PRACTICE; WITH OTHER SUPPLEMENTARY PAPERS, TABLES, ETC.

MEMOIR, ETC.

*** THROUGHOUT this Work the given LONGITUDE is the LONGITUDE from GREENWICH. In the SAILING DIRECTIONS the BEARINGS and COURSES are those by COMPASS, unless where otherwise expressed; but those given thus [*W.S.W.*] signify the TRUE: and the given direction of Wind, Tide, and Current, is generally to be considered as the TRUE.

SECTION I.

REMARKS ON THE CHART, WITH TABLES OF DETERMINED POSITIONS, AND THE AUTHORITIES, ETC., INCLUDING NOTES ON THE LIGHTHOUSES AND VARIATION OF THE COMPASS.

THE accompanying Chart, which is, we believe, the only one that exhibits the WHOLE of the Atlantic Ocean *upon so large a scale*, has been constructed with the particular view of superseding the general use of the Chart on four sheets, distinguished by the name of M. FLEURIEU, whose observations regulated many of its important points, but which was really constructed by the late M. DE LA ROCHETTE, and originally published in the house whence the present Work issues, in the year 1777.

The merits of that Chart were universally admitted; of which, exclusive of a long-continued and great demand for it, some degree of proof may arise, from its having been, during this period, more than once carelessly and coarsely copied, and illegally republished, without any attempt at amendment. Many defects in it having, however, been latterly ascertained, it has been deemed more eligible to construct a new one, founded on the improved state of hydrography, and agreeable to the most recent observations, than to amend and repair that draught.

Upon the former Chart its respected compiler observed, that, "it is the third of the kind made public; the first having been published some years before at Amsterdam, in four sheets, by M. Vankeulen, under the title of the *Spanish* or *West Indian Sea;* it contains some useful details, amidst a thousand errors. The second, entitled *A Chart of the Atlantic Ocean*, was engraven at London, on the circular projection, invented by the late Mr. Murdoch, but was found to be extremely inaccurate; and the constructor added to the Archipelego of Cape Verde, two islands, under the names of St. Philip and St. John, neither of which existed; these names being sometimes given by the Portuguese to the Islands Fogo and Brava." M. Rochette adds, that, "in composing his Chart, he had many helps for the detail of the coasts; and that they were corrected by the best astronomic observations."

As our present object is not to give a history of Charts, we shall only add, that the determinations before made use of, which have been confirmed, have been strictly adhered to; and later observations have been carefully compared with those which have preceded them. The result of a general comparison has been, that many positions, *rejected* by the Editors of the most authentic Tables of Positions, have been retained; while others, though subsequently given, have been merely taken into comparison; and a few, from their discordance, altogether rejected.

It is to the extended practice of lunar observations, and the use of chronometers, since the year 1768, that we owe our great improvements in modern hydrography. The geographer is happy in the consciousness of knowing that this scientific practice is now very generally understood, both in Europe and America. Chronometers in the hands of inexperienced persons have, however, been productive of some mischief; and may produce more, if not counteracted by vigilant attention and critical examination. Yet, while we contemplated this fact, it affords a pleasing reflection that enough has already been done, in the more important tracts of the globe, to furnish the means of comparison, and thus prevent a retrogradation. It cannot, indeed, be supposed that all who practise these methods are equally skilful and experienced; or that, even if skilful and experienced, they can possess instruments equally correct. The most accurate observer with an imperfect instrument, and the imperfect observer with an excellent instrument, obtain results equally erroneous. But such truths, with their consequences, are so obvious, that we hasten to the detail of authorities on which the Chart is grounded.

To the GRAND TRIGONOMETRIC or ORDNANCE SURVEY of England and Wales are owing the positions of all the points in the southern, S.W., and western parts of the kingdom; and to that of FRANCE are, in like manner, owing the equally correct positions of all the points of that country. By Captain MARTIN WHITE, and other officers employed by the British Admiralty, the Great BANK of SOUNDINGS, and the general soundings of the ENGLISH CHANNEL, have recently been taken and correctly delineated; and they now form a most important and peculiar feature of the new Charts. Superadded we have now, in the important additions of Captain A. T. E. VIDAL, 1830-31, the great banks on the West of the British Isles, from the parallel of 52° to that of 62° N., including that of *Rokol*, which had never before been known: and, from the excellent Surveys of Captain WM. MUDGE, R.N. &c., and the Grand Trigonometrical Survey of that country still in progress, a considerable portion of IRELAND. The Coasts of SPAIN and PORTUGAL have been laid down in accordance with the valuable Surveys of TOFIÑO, FRANZINI, &c.; and in the delineation of the AFRICAN COASTS, with the islands off the same, we have followed the positions afforded by Messrs. FLEURIEU, VERDUN DE LA CRENNE, BORDA, PINGRE', and ROUSSIN, of France, with those of Captains BARTHOLOMEW, F. W. OWEN, VIDAL, MUDGE, BOTELER, and SABINE, and many other intelligent officers of our own country.

The AMERICAN COASTS, originally exhibited according to the observations and surveys of our illustrious countryman, Captain JAMES COOK, those of Lieutenant MICHAEL LANE, of Mr. DES BARRES, of Captain HOLLAND, of Messrs. WRIGHT, MASON, and DIXON, have been materially rectified by Captain BAYFIELD, Messrs. DE MAYNE, HOLBROOK, and BULLOCK, the British Surveyors; with the observations of Dr. RITTENHOUSE, Mr. ELLICOTT, Mr. HASSLER, Captain BACHE, and other astronomers, &c., of the United States.*

The given position of the BERMUDAS was determined by the late Captain

* Since the appearance of the first edition of this work, the Editor has compiled the new Map of the VICE-ROYALTY of CANADA, which includes not only the British Canadian territory, but also a considerable portion of the United States. This has afforded him an opportunity of investigating more particularly those points which he had previously considered as doubtful. The results may be seen in the succeeding Tables.

Since the appearance of the second edition, we have been favoured with a manuscript Chart of the Northern Coasts of LABRADOR and UNGAVA BAY, as explored by the missionaries of the *Unitas Fratrum*, in 1811; and from which our Chart of the ATLANTIC, and of the WORLD, have been corrected; also with the positions of several important points in HUDSON'S BAY, &c., which are now given in our "Memoir" on the Northern Ocean.

Thomas Hurd, Hydrographer to the Admiralty, by whom these islands were surveyed, under the order of their Lordships.

For the correct delineation of the West India Islands, much of our earliest information was derived from the labours of Messrs. Puysegur, Verdun, Borda, Pingre', and other foreign officers, whose names will be for ever entitled to respect. They were the pioneers who were followed by the skilful observers acting under the orders of the Hydrographic Directors of Madrid; particularly the Captains Joaquin Fr. Fidalgo, Cosme' de Churruca, and Jose del Rio; to whom, and to Messrs. Humboldt, Oltmanns, &c., we were indebted for the proximate situations of many points of Spanish America. These have again been adjusted by British Officers. Jamaica, and the other Islands of the Colombian Sea, are exhibited according to the best topographic surveys and particular Charts, and these corrected by recent observations.

We may truly add, lastly, in the language of a preceding work, that every source has been exhausted to obtain means for rendering the present one as exact as the state of geography will permit; we, therefore, now proceed to give a detailed account of each determined point, to mention the authorities, and name the observers; in short, to report all that can inspire the navigator with the confidence which we think due to it. This is done in honour to those who have made the observations; to encourage others to imitate them; and to establish the confidence of navigators in those parts of the Chart for which we have had sufficient materials, or to caution them against the few parts not yet accurately known.

The Tables which follow exhibit the Positions of Points assumed in the construction of the Draught, illustrated by Notes. They will be found highly useful in furnishing the mariner, *satisfactorily*, with his required course and distance, to a precision unattainable by the mere use of *any* General Chart; and will, also, be found a useful accompaniment to every particular Chart of the Coasts of the Atlantic extant. These Tables have been enlarged, and they now include the whole of the Irish and Western Coasts.

In the Tables, we quote, in general, the principal authorities only; it should therefore be understood, that many corrections have been made on comparing such with other observations. Minute details are generally uninteresting; and this is the reason why every one is not described. In former Tables, many inaccuracies, amounting to 5, 6, and even to 15 and 20, minutes of longitude, have arisen from mere inadvertence; and many such errors exist, even to the present day, in our books of navigation, from an erroneous allowance for difference of meridians, as that of Ferro, &c., in those cases wherein the longitude has been originally given otherwise than from Greenwich. In some, the longitudes have been indiscriminately admitted from London and Greenwich, as one and the same; these, therefore, abound in errors equal to the difference. We point out such particulars with the hope that those concerned will amend them, for the general advantage of the world. Science illumes the ocean with new means of safety, and the mist of ignorance will shortly be dispelled.

It has been noticed, by more than one observer, that, when the position of a place is given, the *particular point* of it should always be *defined*, and that this point should be some object so fixed and conspicuous that it cannot be mistaken; as a castle, mole, or cathedral; many small differences having arisen from vaguely naming a town or bay. The importance of this hint will be most felt when chronometers are to be rated from a given longitude; and it, therefore, *claims attention.*

POSITIONS OF PLACES, ETC.

I. ENGLAND AND WALES.

*** *The* FIGURES *in Brackets refer to the* NOTES *subjoined to each Section.*

The DESCRIPTIONS of LIGHTHOUSES, &c., follow these Notes.

	LATITUDE. ° ′ ″	LONGITUDE. ° ′ ″	AUTHORITIES.
GREENWICH; ROYAL OBSERVATORY*	51 28 39	0 0 0*	The Astronomers Royal.
LONDON; Cupola of St. Paul's Cathedral	51 30 49	0 5 47 W.	The GRAND TRIGONOMETRIC or ORDNANCE SURVEY of England and Wales, commenced in the year 1784, by the late General Roy, F.R.S., under the direction of the Royal Society; subsequently under the orders of the Masters-General of the Ordnance; and still proceeding under the direction of Colonel Colby, of the *Royal Engineers*, F.R.S., &c.
Gravesend; Church	51 26 39	0 22 10 E.	
Sheerness; Flagstaff	51 26 47	0 44 50 —	
Orford; High Lighthouse	52 5 4	1 34 38 —	
North Foreland; Lighthouse	51 22 31	1 26 47 —	
South Foreland; High Lighthouse	51 8 24	1 22 22 —	
Dover Castle; the Keep	51 7 46	1 19 23 —	
Folkstone Church	51 4 45	1 11 6 —	
New Romney Church	50 59 7	0 56 22 —	
Lydd Church	50 57 5	0 54 29 —	
Dungeness Lighthouse	50 55 1	0 59 58 —	
Bexhill Church	50 50 45	0 28 48 —	
Beachey Head: Station in the Survey	50 44 21	0 15 15 —	These operations, carried on in the most masterly and scientific manner, determine, with the similar triangles of France, hereafter noticed, the relative positions of all the points in the English Channel, &c.
Brighton Church	50 49 32	0 7 40 W.	
Shoreham Church	50 50 0	0 16 19 —	
Selsey Church	50 45 19	0 45 55 —	
Chichester Spire	50 50 11	0 46 43 —	
Sea-Ower Light-vessel	50 39 41	0 39 52 —	
Portsmouth College	50 48 2	1 6 15 —	
Bembridge Light-vessel	50 41 40	1 1 40 —	
South-Sea Castle	50 46 44	1 5 2 —	
Calshot Castle	50 49 7	1 18 6 —	
Hurst Castle	50 42 25	1 32 45 —	
Dunnose; Station in the Survey	50 37 8	1 11 50 —	
St. Catherine's Tower, Isle of Wight	50 35 34	1 17 51 —	
Needles' Lighthouse	50 39 54	1 33 55 —	
Christchurch Head	50 42 38	1 44 31 —	
Poole Church	50 42 51	1 58 55 —	
Portland Upper Lighthouse	50 31 23	2 26 49 —	
Lyme Cobb	50 43 11	2 55 29 —	
Hob's or Bob's Nose	50 27 50	3 26 43 —	
Berry Head; Flagstaff	50 24 2	3 28 14 —	
Start Point; Flagstaff	50 13 27	3 38 21 —	
Bolt Head; Signal Station	50 13 15	3 48 0 —	
Eddystone Lighthouse...[1]	50 10 55	4 15 53 —	
Mewstone, near Plymouth Sound	50 18 31	4 5 33 —	
Plymouth New Church	50 22 22	4 7 16 —	
Plymouth Old Church	50 22 15	4 7 32 —	

REMARKS.

* GREENWICH.—From 720 observations of the Pole Star, made during eighteen months of 1825 and 1826, the latitude of the Royal Observatory was deduced as 51° 28′ 38″·955. Say, as in Table, 51° 28′ 39″. It was formerly given 51° 28′ 40″.

ENGLAND AND WALES—CONTINUED.

	LATITUDE.			LON. W.			AUTHORITIES.
	°	′	″	°	′	″	
St. Nicholas' or Drake's Island, Plymouth Sound [2]	50	22	4	4	8	18	The GRAND TRIGONOMETRIC or ORDNANCE SURVEY of England, &c., described in the preceding page.
Meridian Pillar, on the Breakwater .... [2]	50	20	19	4	9	32	
Penlee Beacon	50	19	25	4	10	40	
Rame Head; Flagstaff......	50	18	53	4	12	29	
Dodman or Deadman Point; Flagstaff....................	50	13	20	4	48	1	
St Anthony's Head; Flagstaff	50	8	35	4	59	31	
Pendennis Castle; Flagstaff	50	8	49	5	2	45	
St. Keverne Steeple	50	3	7	5	5	8	
Blackhead; Flagstaff	50	0	27	5	6	35	
LIZARD Upper Lighthouse [3]	49	57	40	5	12	6	
St. Michael's Mount	50	7	3	5	28	37	
St. Paul's Steeple, Mount's Bay ....[4]	50	5	26	5	32	43	
St. Leven's Point; Flagstaff	50	2	16	5	40	46	
Land's End Stone............	50	4	8	5	41	31	
Longships Lighthouse	50	4	4	5	44	43	
SCILLY ISLANDS; St Agnes' Lighthouse, *revolving* [5]	49	53	36	6	20	38	
————; St. Mary's; Windmill	49	54	32	6	16	59	
————; St. Mary's; Flagstaff at the Fort......	49	55	0	6	18	13	
————; St. Martin's; Day-mark	49	58	2	6	15	53	
St. Agnes' Beacon, Cornwall	50	18	28	5	12	57	
Trevoise Head	50	32	57	5	1	54	
Hartland Point	51	1	21	4	31	21	
LUNDY ISLAND; Lighthouse	51	10	6	4	40	16	
Minehead Steeple............	51	12	42	3	28	4	
Bridgewater Spire............	51	7	41	2	59	39	
Bristol Cathedral	51	27	6	2	35	29	
Flatholm Lighthouse.........	51	22	35	3	7	4	
Swansea Castle	51	37	13	3	55	32	
Mumble's Lighthouse	51	34	0	3	57	20	
Worms Head..................	51	33	56	4	18	56	
Rosilly Barrow	51	34	36	4	15	51	
Pembrea Steeple	51	41	18	4	15	28	
Tenby Spire	51	40	20	4	41	51	
Caldy Island; Lighthouse	51	37	56	4	40	57	
MILFORD Steeple ......[6]	51	42	43	5	0	39	
Hulberton Church............	51	42	56	5	3	11	
St. Anne's High Lighthouse	51	40	59	5	10	2	
The Islet Grassholm......[6]	51	43	55	5	28	40	
Smalls Lighthouse ......[6]	51	43	17	5	40	6	
St. David's Cathedral	51	52	56	5	14	53	
Ramsey Island; highest point	51	51	43	5	20	44	
Bishop and Clerks; northernmost	51	54	10	5	23	6	
Cardigan Isle; highest point	52	7	54	4	41	26	
Cardigan Steeple	52	4	59	4	39	17	
Aberystwith; Station	52	25	40	4	3	19	
Holyhead Signal Staff	53	18	50	4	40	26	
Skerries Light	53	25	18	4	36	24	

REMARKS.

In the public journals of 1824, it was stated that Dr. TIARKS had ascertained, in the summer of 1822, by the comparison of sixteen excellent chronometers, carried backward and forward between Greenwich and Falmouth, that the western longitude of the latter had been given at 4·4 seconds of time, or 1 minute and 6 seconds, too little, by the Trigonometric Survey. In consequence, twenty-nine of the best chronometers belonging to the Admiralty were subsequently committed to the care of the doctor, and a vessel was appointed wherein he was to sail, backward and forward, between Dover and Falmouth, until the longitude in time, between these stations, and between them and Portsmouth, as an intermediate station, was settled beyond any doubt. The result has been that, as to all places on the South Coast of England, between the meridians of Greenwich and Falmouth, if 1 second be added to every 4 minutes of longitude, as given by the Survey, the exact longitude, according to the chronometers, will be obtained.

By reference to Note 3, it will be seen that Dr. Bradley, in 1769, gave the Lizard Point rather more than a minute westward of the longitude assigned by the Trigonometric Survey; and, by Note 5, it is shown that the same result was obtained by Captain Huddart, in the longitude of St. Agnes, Scilly. It will be sufficient for the mariner, if he assumes Pendennis Castle as 5° 3′ W., the Lizard as 5° 12′, St. Agnes' Lighthouse at 6° 20′, &c.

ENGLAND AND WALES—CONTINUED.

	LATITUDE.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
The West Mouse	53 25 4	4 33 11	The GRAND TRIGONOMETRIC or ORDNANCE SURVEY of England, &c.
Amlwch Steeple	53 23 0	4 19 17	
Great Orme's Head; Signal	53 20 6	3 51 7	
Abergelé or Abergali Steeple	53 17 8	3 34 57	
Air Point Lighthouse.........	53 21 26	3 19 14	
Bidstone Lighthouse.........	53 24 6	3 3 46	
LIVERPOOL; St. Paul's Church	53 24 39	2 59 30	
Formby Light	53 32 21	3 3 54	
Formby N.W. Mark.........	53 32 32	3 5 28	
Rossal Point Landmark ...	53 55 15	3 2 56	
Lancaster Steeple	54 3 4	2 48 14	
Walney I. Light	54 2 56	3 10 32	
St. Bees Head; Lighthouse	54 30 50	3 38 7	
Whitehaven; Windmill near	54 32 44	3 35 38	
Workington Chapel	54 38 28	3 34 11	
Southerness; Lighthouse...	54 52 23	3 35 36	
Criffell; Station in the Survey, 1,831 ft. above the sea	54 56 44	3 36 55	
ISLE OF MAN.			
Point of Ayr Light	54 24 59	4 21 59	
North Berule; Station, 1,804 feet high	54 17 27	4 23 32	
Snea Fell; Statn., 2,400 ft.	54 15 50	4 27 35	

NOTES.

1. EDDYSTONE.—There are several reefs, or ridges of rock, in the vicinity of the Eddystone or House Rock. Of these, the southern one extends to the distance of about 78 fathoms from the Lighthouse. The East Rock lies at 65 fathoms eastward from the same; and the N.E. Rock, N. 60° E., true, at 150 fathoms.

The following particulars have been given by Mr. Smeaton. High water, at full and change, V¼ʰ. Rise of spring tides, 16 to 18 feet; neaps 10 to 11. Tide up Channel, from West to East, from half flood to half ebb; and runs down the Channel, from East to West, from half ebb to half flood. As the turn of the tide is not at high or low water, but three hours after each, the tide is here said to run tide and half tide.

2. ST. NICHOLAS' or DRAKE'S ISLAND.—Mr. Bayley, from his observations made in the Observatory of Drake's Island, in 1772, concluded its latitude to be 50° 21′ 28″; and the longitude, by means of the occultation of a star by the moon, compared with correspondent observations made at Greenwich, as 4° 13′ 30″. See "*Observations made during the Second and Third Voyages of Captain Cook*," by order of the Admiralty.

On the inside of Plymouth Breakwater is a landing-pier, and on the East end of this, which is about equi-distant from either end of the breakwater, is a granite pillar, with a brass plate, on which is engraved its correct latitude and longitude, 50° 20′ 18″·8 N., and 4° 9′ 32″·1 W. Here ships of war, by Admiralty order, rate their chronometers before proceeding to sea.

Captain FitzRoy has remarked that the longitude of this station, by the Ordnance Survey, would be 4° 7′ 41″·7; but, by applying a portion of the error detected by Dr. Tiarks, in his chronometric observations between Greenwich and Falmouth, viz. 4·09 s., or 1° 11′ 3″, the corrected longitude of the station will be 4° 8′ 43″. "Our chronometers made it 0′ 40″·2 to the eastward of the corrected longitude, and 0′ 19″·6 to the westward of the original determination by the ordnance Survey."—*Captain FitzRoy's Appendix*, p. 320.

3. LIZARD POINT.—Dr. James Bradley, Astronomer Royal, from the mean between

the results of several observations on the satellites of Jupiter, the passage of Venus over the sun in June, 1769, and an eclipse of the sun on the 4th of June, in the same year, deduced the latitude of the Lizard Point as 49° 57′ 30″, and its longitude 5° 13′ 0″.

4. ST. PAUL'S STEEPLE is given in the requisite Tables from the Ordnance Survey, as in 50° 1′ 24″ N., and 5° 21′ 42″ W., instead of the position since given, as in the present Table. The position will, also, be found corrected in the tabular statement of determined positions attached to the particular plans, in the collection of Harbours of the English Channel, &c., lately published by Mr. Laurie; and which exhibit other emendations. The collection of Harbour Charts here alluded to, with its companion, the General Chart of the Channel, indisputably constitute one of the finest, most accurate, and most useful works of the kind that have ever appeared.

5. ST. AGNES' LIGHTHOUSE, SCILLY.—The observations made for determining the situation of St. Agnes' Lighthouse, at the commencement of the third voyage of Captain Cook, prove to be incorrect. It appeared, from these observations, to be in latitude 49° 55′, longitude 6° 45′. This error, of more than 25 minutes of longitude, has been very injurious; inasmuch as many Charts were subsequently regulated by the deduction. For, the Lizard Point having been previously determined by Dr. Bradley, these islands were, in consequence, placed much too far from the Land's End. The fluctuation has, however, been completely set at rest by the Trigonometric Survey and the observations of the late Captain HUDDART. This gentleman, many years ago, visited the Scilly Islands, having with him a watch made by *Arnold;* and obtained his time, at that spot where the body of Sir Cloudesley Shovel is said to have been thrown ashore, by means of equal altitudes of the sun's limb: he then found, comparing his time with that shown by the watch, that 0 h. 25 m. 18 s. was the difference in time between the meridian of Greenwich and this spot in St. Mary's. Now, St. Agnes' Lighthouse is about 2 minutes of a degree West of the place to which Captain Huddart alludes: therefore 25′ 18″ + 8″ = 25′ 26″ is the longitude of St. Agnes by these means; which differs only 4½ seconds in time, or little more than 1 minute of longitude, from that found by the Survey.—*Trig. Surv.* Vol. II. p. 135.

6. SMALLS, GRASSHOLM, MILFORD HAVEN, &c.—In the third volume of the Account of the Trigonometric Survey, the longitude of Grassholm, is stated to be 5° 47′ 1″, and that of the Smalls Lighthouse is printed, 5° 58′ 34″; but they are stated in the Table from the most recent determinations. In the same volume, Milford Steeple is given as in 5° 20′ 13″, instead of 5° 0′ 39″ W.; and that of Hulberton, as in 5° 21′ 47″, instead of 5° 3′ 11″ W. The station of CEFN BRYN is likewise given as in 4° 56′ 19″, instead of 4° 7′ 25″; the difference between it and Moel Rhyddlad having been added, instead of subtracted.

Pembrea Steeple is also given, in the same way, as in 4° 48′ 16″, instead of 4° 15′ 28″ W. —See *Trig. Surv.* Vol. III. p. 380.

VARIATIONS OF THE COMPASS.—The variation of the compass, at London, according to the observations made in 1824, was 24° 9¼′ W. In the Thames' Mouth, at the Nore, it is 23° 30′: off the North Foreland, 23° 10′ W., 1843. When Mr. Spence made his Survey, 1795, it was only 22° 50′; but it increases to the westward. At Dover, in 1833, it was 24°. At Spithead, in 1813, it was nearly or rather less than 25°. At Portsmouth Observatory it was given, in the same year, as 24° 15′. At Devonport, 25° W., 1831. At the Scilly Islands, in 1814, it was ascertained by Mr. Bain, and found to be nearly 27½° W. This gentleman says, "In September, 1814, I determined the exact quantity of the variation at the Scilly Islands. The *Sybille* having continued two days at St. Mary's, during that interval I went with an azimuth compass, artificial horizon, and sextant, to St. Agnes' Lighthouse, and there took *twelve* observations, the mean result of which gave 27° 16′ West variation. In the evening I went, with the same instruments, to St. Mary's Castle, and there ascertained the variation, by an excellent amplitude, to be 27° 31′ W. The mean is 27° 23′ 30″ W." See, further, the New Chart of the English Channel, &c. The present variation is very nearly the same. At Lundy Island the variation was 26° W. in 1832; in Milford Haven, 27° in 1830; off St. David's Head, 26° 15′ W.; in Cardigan Bay, 1838, 26° 10′ W.; off Holyhead Island, in 1838, it was 26° 35′ W.; in Beaumaris Bay, 26° 15′ W.; and in Liverpool Bay, 26° W. in 1838.

The variation at the Royal Observatory at Greenwich, in 1844, was between 23° 19′ 22″ and 23° 18′ 42″ W.; mean 23° 18′ 59″. It varied considerably in 1843; on May 4th, it was 23° 6′ 10″. The mean Magnetic Dip is 69° 0′.

OF LIGHTHOUSES AND THEIR ILLUMINATION.

(1.) The Lighthouse Systems at present in operation on the coasts of England and France are well worthy of far greater attention than they generally receive, both for the regularity and perfection of their arrangements, and for the beautiful adaptations of science which they exhibit. A few remarks on their nature will therefore be an appropriate introduction to lists and descriptions of the lights which follow.

(2.) It is of the utmost importance to the sailor, that one light should be readily and clearly distinguished from another; the melancholy effects of mistakes on this point are too familiar. Every means, therefore, of so distinguishing a light, should be made use of; and one point in furtherance of this, is the system employed in the illumination of the lighthouses, between the various methods of which it will be seen that there are some well-marked or minor features, which serve to give a distinctive character to lights which may have, otherwise, the same general appearance.

(3.) *Lighthouses* consist of two classes; those built on the land, which do not differ, in the principles of their construction, from ordinary buildings; and those erected on isolated rocks, such as the Eddystone, and that on the Héaux de Brehat, which have demanded the most refined judgment and skill to combat with the enormous force of the waves. Another description of erection consists of iron piles, either secured to the rocks, or on a large screw forced into the sand, and which support the lighthouse. An example will be found in the Maplin Lighthouse, in the mouth of the Thames. This latter mode of construction is also applied to the erection of *beacons.*

(4.) *Light-vessels,* employed where buildings have been hitherto impracticable, are of peculiar construction, and always painted *red,* with their name, in conspicuous white letters, on their sides, and carry at their mast-heads one or more skeleton balls, as described, which, in case of the vessels driving, are lowered, in indication of such an occurrence. During fogs or snow storms, from each of these vessels is sounded at regular intervals a Chinese gong, the very peculiar and powerful sound emitted by which is not likely to be mistaken for anything else. Light-ships are very strongly moored, either with a single mushroom anchor, or with a span and bridle. *Buoys* are generally conical, or can-buoys, and are moored with a block of iron, called a sinker; they are generally repaired and painted twice a year. Buoys, showing the situation of sunken rocks, are nun-buoys, painted green.

(5.) The *lamps* used for the illumination of lighthouses are upon the principle invented by Argand, about 1780. The smallest of them consists of a single cylindrical wick, of nearly an inch in diameter, and the air is made to ascend through the tube to the centre of the flame, by means of a glass chimney placed around it, and does not differ from that in universal use. This single wick lamp is used for the parabolic reflectors; and usually are several in number in a lighthouse. Where a single and more powerful light is required, a lamp of more complicated construction, though of the same principle, is employed. The largest of these has four concentric wicks, the outside or largest being 3¼ inches in diameter, and the central or smallest five-sixths of an inch. From the great heat which this powerful lamp evolves during its burning, which is sufficient to char the wicks, the oil is made to flow copiously over them, so that the quantity supplied to them is about four times more than is consumed at the time. This is effected either by means of small pumps, moved by clockwork, or by springs or weights pressing on the reservoir, or by the pressure of condensed air. The lamp with four wicks is of the first order; for the second it has three wicks, for the third two, and the fourth one wick.

(6.) The oil now employed both in the English and French lighthouses is called colza oil, and is expressed from the seed of a species of rape or wild cabbage. Till within the past year the best sperm oil was alone used in the English lights.

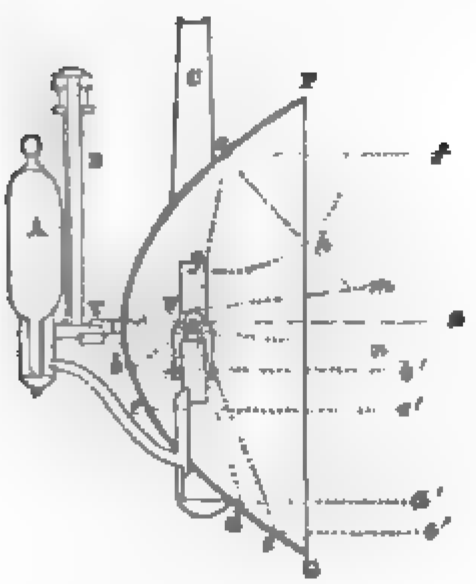
(7.) The effect of a lamp in issuing rays, is to fill a sphere whose diameter is double that of the distance to which such a light can be seen. But as only those rays are serviceable which are visible in a horizontal or nearly horizontal direction, those which pass beyond these limits must be turned into it. To do this we have two alternatives—one to reflect the light by polished mirrors, the other to refract it by glass lenses placed before the light.

(8.) When polished silver reflectors are used *behind* the light, it is called the *Catoptric* system, and is that most generally in use in England.

(9.) Where glass lenses are used before or around the light, it is called the *Dioptric*

system, and is that most generally in use in France. Hence these two systems are frequently known by the names of the respective countries.

(10.) The *Catoptric* or reflecting system is dependent upon the peculiar properties of the parabolic curve to which the reflectors are formed. The parabola is a conic section, which the adjoining diagram, a section of a reflector and lamp, will serve to illustrate. In this, P V G is a vertical section of a reflector; F the flame of the lamp; A the oil fountain, containing about 1½ pints, the whole of which lamp and burner slides, by means of a small frame, up and down the rod B, in order to trim and clean it, and return it exactly to its place. The smoke and heat are carried away by the ventilating tube C.



The line P V G is such a parabolic curve, and within it is a point F, which is called the focus of the parabola, and is the situation of the flame. Now, it is a fundamental law in optics, that the angle of incidence is equal to the angle of reflection; that is, the angle at which a ray of light is thrown off a reflecting surface is equal to the angle at which it is received; thus the angle V *a g* at which the ray F *g a* falls on the surface of the parabola at the point *a* is equal to the angle P *a f*, at which it is reflected from the surface; therefore, the angle made by the ray falling on, and being reflected from, the surface, will be bisected or divided into two equal parts by the perpendicular to the tangent of the parabola at the point of incidence, therefore the angle *g a f* is bisected by *g h m*, that is, the angle *g a h* is equal to the angle *h a f*. The peculiar property of the parabolic curve is that the ray, when reflected from any point, is always thrown in a direction parallel to the axis of the curve; that is, the direction *a f* of the reflected ray is parallel to the axis F Z.

(11.) Thus a copper reflector, lined with highly polished silver, formed to such a curve, with a mathematical point of light placed in its focus, as F, will reflect the rays from it in straight lines, parallel with its axis V Z, as F *b b′*, F *c c′*, F *e e′*, &c., and thus send forth a cylinder of light, whose diameter is equal to the double ordinate or opening or mouth of the reflector, P G.

(12.) Supposing, then, that we wished to produce a complete circle of light all around the horizon, it is evident that it could not be done with any number of such instruments; there would be dark intervals between the direction of their axes, if they were placed in a circle.

(13.) But here another circumstance occurs. The flame used is not a point of light, but is nearly an inch in diameter, and this subtends an angle at the vertex V, of 14° 22′, or the angle *m* V *n*, in the reflectors ordinarily used in the Trinity House lights, which are 21 inches in diameter (P G), and 4 inches in focal length (F V). Therefore, combined with other circumstances, about 15° or 17° of divergence may be considered effective, and it would take from 25 to 33 of such reflectors to make a complete circle of light.

(14.) The brilliancy of the ray from this reflector is considerably stronger in the direction of the axis, that is, when viewed directly in front, than it is for some distance on either side of that direction; and at great distances, in *fixed* lights, when you are in the direction *between* the axis of the adjoining reflectors, the light is frequently glimmering and feeble, but a small change in the position of the ship brings you again into the brighter beam of the reflector, one of which, it will be understood, is only in sight at a time. This is an important observation to the sailor, in distinguishing one fixed light from another, of different description of apparatus.

(15.) When a revolving light is required, a number of these reflectors are fixed to the sides of a triangular or quadrangular iron frame, and the whole caused to revolve in regular periods, by means of clockwork. The reflectors on each side of the revolving frame, from four to eight in number, are thus successively directed to every point of the horizon; and the combined result of their rays form a flash of greater or less duration, according to the rapidity of their revolution.

(16.) From the amount of *divergence* (13) the period during which such a light will remain *visible is from 12 to 15 seconds*, the light gradually increasing, and as gradually

diminishing. And as the action of the reflector is only in the direction to which it is placed, the intervals between the flashes will be quite dark, for a shorter or longer period according to the distance from which it is viewed, whether it is beyond that to which th unassisted flame will reach.

(17.) The light from a revolving catoptric or reflecting system is much brighter than from a fixed light on either principle, as you have the combined effect of several refle tors, each of which gives an equal amount of light, it is calculated, to 350 to 450 suc lights without any reflectors.

(18.) In floating light-vessels the light is always shown from parabolic reflectors. These are smaller than those used in lighthouses, being 12 inches in diameter. For fixed lights, eight lamps and reflectors, each suspended on gimbals, or on ball and socket-joints, so that they always maintain their perpendicularity, notwithstanding the rolling of the vessel, are arranged in an octagonal lantern, which goes round the mast, and is hauled up to the mast-head when on service, and is let down on the deck during the day, or while the lamps are trimming. Revolving lights for floating light-vessels have four lamps, and similar reflectors, and the lantern revolves around the mast.

(19.) An apparatus for producing an *intermitting* light, of the only appearance to which such a term is applicable, is in use in three of the Scottish lighthouses, the invention of Mr. Robert Stevenson. It is an arrangement by means of which the light is suddenly obscured by an eclipser, and as suddenly appears again at its full brilliancy. This feature distinguishes it completely from revolving lights, which come gradually to their greatest brightness, and as gradually decrease, and this either from the reflecting or refracting apparatus.

(20.) There is yet another sort of reflector in use in France for harbour lights, called the Bordier Marcet apparatus, from its inventor, or the sideral lamp. It is used with a single lamp, and consists of a circular reflector, about 13½ inches diameter, formed by the revolution of a parabola around its focus in a horizontal plane; the centre of this is taken out to admit the lamp, which thus has all around it, above and below, a reflecting surface, which sends its upward and downward rays in a horizontal direction.

(21.) The lights in the ensuing list, which are upon the catoptric or reflecting system, are distinguished by this mark ●. Their magnitude, or order, is not indicated, as only one reflector is but usually visible at a time; the class of the light is to be inferred from its importance.

(22.) The first notice we have of the use of parabolic reflectors is given by William Hutchinson, in his "Practical Seamanship," published in 1777, as having been used in the Liverpool lighthouses, erected in the year 1763. The formula for the parabolic curve now used was given by Captain Joseph Huddart.

(23.) The *Dioptric* or lenticular system is next to be considered, and depends for its action on the refracting properties of glass. In this the apparatus is placed before the flame, and derives its name, dioptric, from a Greek word, signifying anything looked through; or lenticular, from its being composed of lenses. Its principle may be thus explained:

(24.) When a ray of light passes out of a rarer into a denser medium, as from air into glass or water, or *vice versâ*, it is refracted, or bent, out of its original direction. Of course, this new direction is dependent upon the direction in which it enters into, or emerges from, this second medium. This is familiarly explained in the burning-glass, in which it will be seen that a cylinder of parallel rays of the sun entering one side of the lens, are so deflected, that upon their issuing from it on the other, they form a *cone* of rays whose apex is at a certain distance, dependent on the curved side or sides of the lens, called the focal distance.

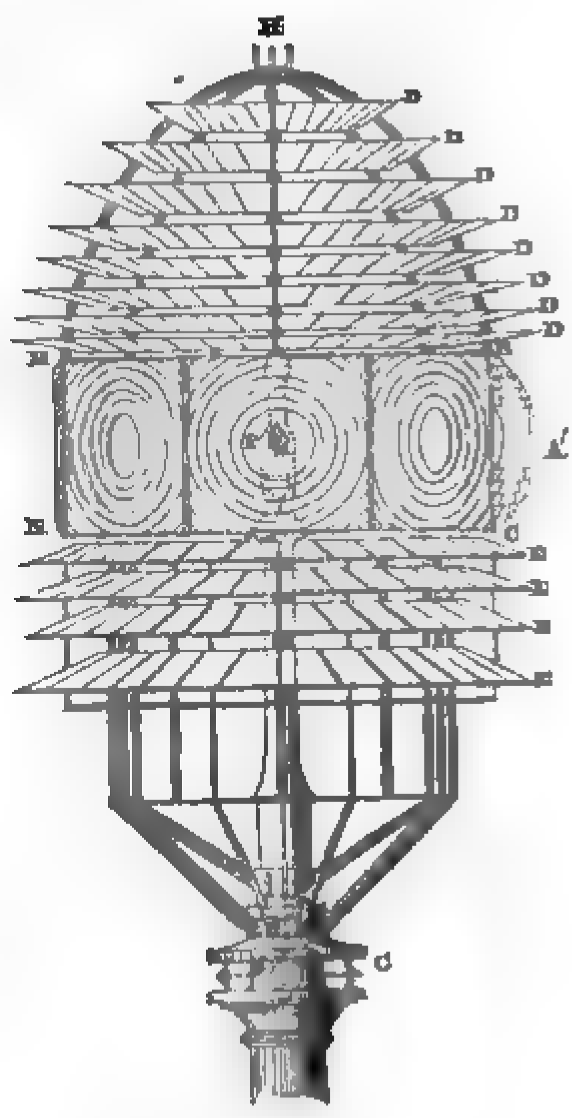
(25.) In the application of plano-convex lenses of 3 feet focus, to the controlling of two-fifths of the entire sphere of light, they must be 2 feet 6 inches in diameter, and if constructed of the usual form of smaller lenses, would be several inches in thickness in the middle, as is shown by the dotted line A′ B C in the diagram (27). This would occasion serious inconveniences: a large portion of the light would be absorbed in its passage; there would be great difficulty in procuring such a mass of glass of anything approaching to uniform density, which is necessary to its proper action; and it would be also of very great weight, and, consequently, be of difficult management.

(26.) To obviate these difficulties, it occurred to Sir David Brewster in 1811, and to

M. Augustin Fresnel in 1819, that the same optical effects might be preserved if a large portion of the solid part of the lens were removed; because the refractive properties of the lens depends upon the relative direction of its surfaces. They therefore proposed the lens now in use for lighthouse purposes. It is called the polyzonal or annular lens, because it consists of a series of zones or rings, instead of being of one uniform curve or surface, and is represented in the central portion of the diagram of the apparatus in (27). The normal or proper form of the lens would be of the section shown by the dotted line A′ B C; but the relative direction of the outer curved surface to the inner flat one is preserved in the separate rings of which the lens is built. There is one great advantage in this method, that the lens may be built to any size, and yet not be thicker, and may be made square, so as to economize every portion of light which may be thrown on the zone of the breadth of their diameter. The dioptric system was perfected by the late M. Augustin Fresnel, the director of the French lights, and is sometimes called by his name.

(27.) For a *revolving* light of the first order, or largest size, eight of these lenses are formed into an octangular belt M N B C, of 6 feet 0·5 inch in diameter, having the flame of the lamp, F, described (5) in their common focus. Therefore as the action of these lenses is the reverse of that of the burning glass (24), by sending forth parallel rays of light, which enter the lens in the form of a cone from the focus within; this part of the apparatus will send forth eight beams of light in the direction of their axes, or the lines between the lamp and their centres; between these directions the light will not be seen. The apparatus being made to revolve, say, in eight minutes, by means of machinery, it follows that a bright beam, gradually increasing in intensity, and then diminishing, will be presented to the eye each time that one of these lenses passes before it, that is, once every minute.

(28.) The duration of these flashes is dependent on the power of divergence in the lens. If the light were a mathematical point, as supposed in the case of the reflector (11), the flash would last but a single instant, but the breadth of the flame being 3·39 inches, this, at the focal distance of 3 feet, subtends an angle of 5° 9′, and consequently the duration of the flash is while this angle is passing, or about seven seconds. These separate lenses form the principal or most powerful portion of a revolving dioptric light.



View of a first order revolving dioptric light, with upper and lower reflecting zones.

(29.) For a *fixed* light on the dioptric principle, another adaptation of it is used. As the object is now only to bend those rays, which would pass upwards or downwards into a horizontal direction, and not to interfere with the direction of those which pass laterally, the central portion of the apparatus (M N B C in diagram 27) is formed into a continuous belt, or rather series of belts (D E E G in 36), whose section is identical with that of the polyzonal lens, as will be seen by referring to the figures (27 and 36). It will be evident that such an arrangement distributes the light evenly all round the direction in which it is placed, and thus affords a means of distinction for the sailor, to discriminate such a fixed light from one on the catoptric or reflecting principle, when the light is not quite even all round, but is strongest when immediately in front of the reflector (14); this is an important feature.

(30.) Where a fixed light is not required all around the horizon, the lens apparatus is not carried round on that side; but in some instances, as in the St. Catharine's light, Isle of Wight, the deficient angle is filled up with spherically curved metallic reflectors;

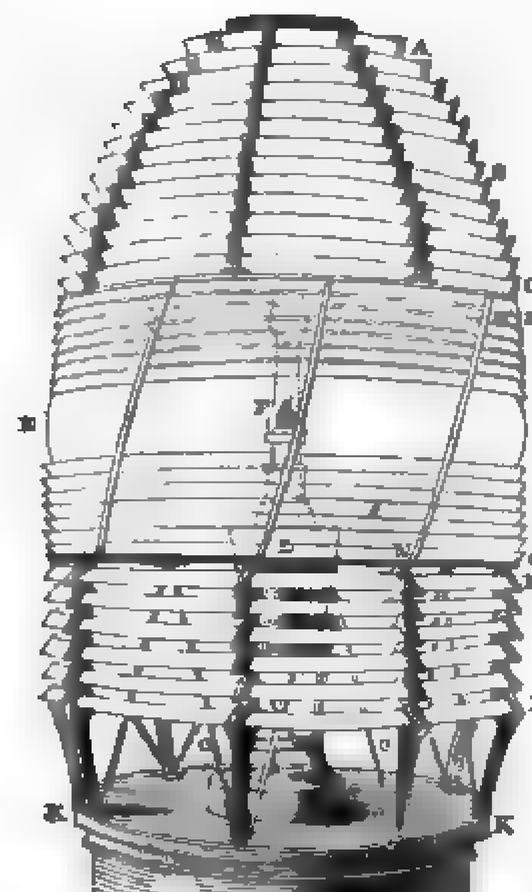
these return the light, which would otherwise be lost, through the centre of the flame on to the refracting apparatus, and thus materially add to its power.

(31.) The central portions of the apparatus which we have been describing economise about two-fifths of the whole of the rays issuing from the central lamp, but does not affect those which pass above or below their action, and which would therefore be lost for useful effect without some additional controlling apparatus. This is of two kinds; either *reflecting*, being formed either of numerous silvered glass mirrors, or else of *reflecting* and *refracting* glass prisms.

(32.) In the diagram (27) the upper and lower system of catoptric or reflecting zones are represented by the letters D D and E E. The upper series, it will be seen, consists of a series of seven rings, covered with plates of looking-glass, which are inclined towards the flame at such an angle, that they reflect the light in an horizontal direction, and thus add their effect to the power of the central portion of the lenses. The same remarks apply to the lower series, or the four beneath the flame; and they may be considered, as each of the faces, forming a portion of a parabolic curve, whose focus is in the flame of the lamp (10). In a first order light apparatus on this system there are 264 separate mirrors in the 11 zones. But this position of the apparatus is now in course of change for the following, in all the English and French lights.

(33.) In the earlier period of the introduction of the dioptric system, a more beautiful adaptation of science was alone used for the smaller apparatus, in the form of cata-dioptric or totally reflecting prismatic glass zones, above and below the principal lenses. It has recently been introduced into the largest apparatus, upon the suggestion of Mr. Alan Stevenson, the engineer to the Scottish lighthouses, and has most materially increased the efficiency of the whole system. They are represented in the diagram (36) A B C H I, and may be thus described:—

(34.) When a ray of light is thrown on a glass surface at a more acute angle than 41° 49′, instead of passing out again it is *totally reflected* from that point, and this is of no importance whether it is within the body of the glass or on its external surface. Therefore these prismatic zones A B C (36), are so arranged in the form of a cupola over the flame, that the upper and curved surfaces of each of them shall be at such an angle to the focal flame that the rays issuing from it shall, after being refracted from the under side, be received upon the inner surface of the upper side, be again refracted and issue from the outer side, in a perfectly horizontal direction.



View of a first order fixed dioptric light, with upper and lower cata-dioptric or refracting zones.

(35.) This is one of the greatest refinements of practical science, and so perfectly does it fulfil its office, that the only loss of light is that which is absorbed by the glass of which the prisms are composed. These cata-dioptric zones are necessarily very much more costly than the ordinary catoptric or reflecting zones, but they increase the power of this part of the apparatus more than in a corresponding degree, though their general effects are not otherwise distinguishable from one another.

The distance to which the light from these zones is visible, is about 10 or 8 sea miles, according as the apparatus is of the first or second order.

(36.) The apparatus figured in the adjoining diagram shows this the most beautiful and simple of all the light apparatus, and has every refinement and improvement hitherto effected in the system. The central and *principal portion* of this is the refracting bands, D E E G (29), which are 6 feet 0·5 inch *in diameter, between E E,* and having the flame, F, of the lamp, L, in the focus. This

central band merely *refracts* the rays from the focal lamp which fall upon its inner surface, at every angle between C F and G, into horizontal beams, parallel to the central line, E E; and this of course in every direction in azimuth. As it is impossible to construct such a series of belts in one entire circle, they are made up of eight panels, united by narrow brass frames, M N. If these frames were placed perpendicularly, they would obstruct every portion of the light which falls upon the angle of their breadth; to equalize this obstruction, therefore, Mr. Alan Stevenson has arranged these frames in a diagonal manner, so as to have only a portion of their length before any one point. This central belt is supported by the diagonal legs O O, upon the service-table K K. The upper, or hyperpyral, portion of this elegant apparatus consists of thirteen prismatic glass zones A B C. The action of these cata-dioptric and totally reflecting zones is explained in (34). The lower, or hypopyral, series of zones H I, act on the focal rays exactly in the same manner, and the effect of the whole is, as before stated, to send nearly the whole of the rays which would be dispersed in every direction throughout a sphere into a horizontal band of light, whose breadth is equal to the height of the apparatus A I, or about 9 feet.

(37.) In a revolving lenticular light, therefore, the upper and lower portions of the apparatus, affording a constant and steady light, is visible in the intervals between the flashes from the central lenses, and this subordinate light will serve to fix the position of a light during such interval, if it is seen within the distance of 8 or 10 miles. This distinguishes a lenticular revolving light most clearly from one on the catoptric principle, or from parabolic reflectors, the intervals between the flashes of which are generally total beyond the distance of 2, 3, or 4 miles (16).

(38.) There is a more complicated system in use for dioptric revolving lights, which, although there is no example of them in the English Channel, as they are in use in the two finest lighthouses in the world, the Cordonan, at the mouth of the Gironde, and the new Skerryvore, off the West coast of Scotland, we will here describe. Instead of the bands of parabolic mirrors (32), or cata-dioptric zones (34), *above* the central and principal lenses, the apparatus is dia-catoptric, being composed of eight smaller lenses of 19½ inches of focal distance, inclining inwards towards the flame, and forming an octagonal frustrum of a cone of 50° inclination. These are surmounted by plane mirrors, placed so as to reflect horizontally the beams transferred by these lenses. This upper apparatus is fixed at an angle of 7° from that of the eight great vertical lenses. The whole of the apparatus is caused to revolve in eight minutes, and the following is its distant effect. Within 8 miles a constant steady light is seen from the lower zones (37), and once in every minute a small flash is seen for a few seconds, caused by the upper portion of the apparatus. Soon after this smaller flash, the principal lens gives the brightest beam, which may be seen more than 30 miles; this having passed, the smaller flash, after a period, succeeds, and thus in each minute a small and a large flash are visible.

(39.) Among the French system of lights is an apparatus which shows a fixed light varied by a bright flash at regular intervals. The apparatus consists of the ordinary fixed dioptric light with the refracting belt described (29), which is composed of *horizontal* cylindrical elements. Round this central belt one or more panels of *vertically* cylindrical elements is made to revolve. This revolving panel causes the horizontally divergent beams to be parallelized in azimuth, and thus the appearance of the light from the entire apparatus will be a fixed light, then a short eclipse caused by the deflection of the section of light by the revolving panel, then the bright flash from the panel, then another short eclipse, and then the steady light again. Sometimes this flash is of a red colour, the revolving panel being stained for that purpose, as in the case of the new light on Chaussey in the Channel Islands, and several others.

(40.) All these different arrangements are of the most beautiful description, and are well worthy of the sailor's curiosity, should the opportunity of visiting them occur; this is readily granted, and, whether they are considered as regards their intrinsic beauty of appearance, the scientific ingenuity of their construction, the high talent and laborious investigation employed in their perfection, and, above all, their utility, they are worthy of very much more attention than is usually bestowed on them.

(41.) The only means of distinguishing one light from the other is that of causing it to revolve or flash at different intervals, as is almost exclusively used in the French lights, or by means of colour, as is more in use in our own harbour and tide lights. The colour which alone *seems adapted for this purpose* is *red*, and this is applied to dioptric lamps

by a cylinder of ruby-coloured glass, stained with a preparation of gold, placed around the lamp; or if to the ordinary reflector, a pane of this coloured glass is placed before the reflector. The use of colour is objectionable on one score, that of the greatly diminished power of such a light. In a bright light, revolving and showing alternate red flashes, these last will not be visible so far off as the bright light, and give the appearance of longer or unequal intervals in its appearance. Some means of clearly distinguishing one lighthouse from another is still a great desideratum.

(42.) Respecting the comparative merits of the two great systems, we have an illustration of two fixed lights, on each system, in the South Foreland lighthouses. The only feature of superiority in the lenticular light is the evenness with which it distributes the rays around the horizon (29). With the revolving lights, by referring to (16), it will be seen, that with the reflector light, however bright the flashes may be, the eclipses between them are complete, even at short distances (14), while in the dioptric lights there is always a subordinate light visible (37) to the distance of 8 or 10 miles, and which usefully serves to keep the situation of such a light in view. We have not space to enter here upon the economy of the systems, but it may be questioned whether the one possesses any very great superiority in this respect over the other, as is asserted, though, if any, it is decidedly in favour of the lenticular apparatus.

(43.) Dioptric lights are divided into 4, or rather 6 orders, according to their magnitude:—

1. The *first* order apparatus is 6 feet 0·5 inch in diameter, and is illuminated by a lamp with four wicks, of 3·39 inches, 2·52 inches, 1·69 inches, and ·83 inch diameter, respectively. It is indicated in the following list, by the figure **1.**

2. The *second* order apparatus is 4 feet 7·13 inches in diameter, and is illuminated by a lamp with three wicks, of 2·6 inches, 1·8 inches, and 0·9 inch in diameter, respectively, and is indicated by the figure **2.**

3. The *third* order is subdivided into two sizes, larger and smaller. The first apparatus (grand modèle) is 3 feet 3·38 inches in diameter; and the second (petit modèle) 1 foot 7·69 inches in diameter. They are each illuminated by a lamp with two wicks, the larger of 1·61 and ·807 inches diameter respectively, and the smaller of 1·20 and ·589 inches in diameter. They are shown in the list by the figure **3.** All the lights of this order in the channel are of the larger size.

4. The *fourth* order, or harbour light, is also subdivided into two sizes, the larger (grand modèle) 1 foot 2·77 inches in diameter, the smaller (petit modèle) 11·81 inches in diameter. They are illuminated by a single cylindrical wicked lamp of ·94 inch or ·85 inch in diameter. As the sub-division of this order is unnecessary to the sailor they are either of them distinguished in the list by the figure **4.**

(44.) In addition to the magnitude of the apparatus, the description of it will also serve usefully to distinguish one light from another. Therefore the different systems employed, as described in the foregoing paragraphs, are designated by the letters **a, b, c, d,** attached to the figures indicating their sizes, as follows:—

a. A *fixed* dioptric light apparatus, having a dioptric belt (29), and cata-dioptric prismatic zones (34), and is figured in (37). This is the most perfect system for fixed light apparatus.

b. A *fixed* light apparatus, similar to the above, but with reflecting zones, described in (32).

c. A *revolving* light apparatus, consisting of eight polyzonal lenses (27) surmounted by the cata-dioptric prisms (34 and 36). The appearance of this light, beyond the distance of 8 or 10 miles, according to the size of the apparatus, is that of a brilliant flash of 7 to 9 seconds duration. Within that distance the fainter light (37) between the flashes is visible.

d. A *revolving* light apparatus, of eight lenses as above, with reflecting zones, described (32). The appearance of this light will be a bright flash beyond the distance of 8 or 10 miles, according to the size of the apparatus, and within that distance a continuous fainter light, not so strong as in the previous apparatus.

e. A *revolving* light apparatus, with eight lenses, and the secondary apparatus as described (38).

f. *A fixed light, varied by flashes.* The apparatus is described in (39). Its appear-

ance, which distinguishes it from any other, upon close attention, is, 1st, by the intensity and duration of the fixed light; and, 2nd, by the *short* duration of the eclipse which precedes and follows each brighter flash. The distance to which it is visible is due to the size, that is, the power of the apparatus, and the duration of the short eclipses increases with the distance.

(45.) The range (portée) of the different lights, as given in the table, represents this element very incompletely, inasmuch as the distance there given is dependent on the elevation of the light, and consequent distance of the horizon. The flashes of the principal revolving dioptric lights may be, and have been, seen 50 or 60 miles off, when they are above the horizon, and it may be taken for granted that, should the atmosphere be favourable, that any of the larger lights may be seen from whatever distance they may be sought for from the greatest attainable elevation.

(46.) There is one consideration which it is as well to mention, respecting the heights of the lights above the sea-level. This is given in the tables from the level of *high water at spring tides*, and consequently is their minimum height. This will cause the distance to which they are visible to be increased (with the exception of floating lights) when it is low water, by an amount equivalent to the depression of the sea surface at that period. Of course their respective ranges would be increased, in many instances, by increased height; and this is equally attained by viewing them from the ship's upper rigging. Without referring to these circumstances, the distances are given at a *minimum* for the height of an ordinary vessel's deck, or 10 feet; and the greater portion, unless coloured or harbour lights, may be seen at much greater distances than is stated, if there are means for so doing.

(47.) Atmospheric changes, of course, have the most important effect on the range, visibility, and appearance of lights. In a very clear transparent atmosphere they will have nearly a white appearance; during foggy weather, particularly the dry haze sometimes predominant on soundings, they will have more or less of a yellow or reddish tinge, though they may be seen sometimes much farther through this than would be expected.

(48.) The greatest obscuration is during fogs or damp mists, which are very impervious to light. Perhaps it is scarcely necessary to remind a sailor that a fixed light might put on the appearance of a revolving light, by seeing it through the intervals of the driving clouds of vapour.

(49.) Lights may be divided into three classes according to their nautical importance:—1. *Coast lights*, those which serve for the mariner to recognise the land on approaching it, and are thus of the greatest power; they are marked in the following lists in capital letters, thus, USHANT, LIZARD, &c.

2. *Harbour and Leading Lights.*—These, of less importance than the former in the general system, are used to indicate a port or narrower channel. Some of these, though more limited in their immediate object, may be as important as the first class. Thus the Gull Stream light-vessel, though of limited approaches, is most useful in marking the centre of the Goodwin; it is therefore placed among the first class. The second class is shown in small capitals, as SHOREHAM, CHERBOURG, &c.

3. *Tide lights* show when a harbour has a certain depth of water and is accessible. They are frequently red, and, consequently, are of less power. They are marked in italics, as *Ramsgate*, *Boulogne*, &c.

(50.) The PUBLIC LIGHTHOUSES of England and Wales are under the sole control and management of the Honourable Corporation of Trinity House of Deptford Strond; those of Scotland (the principal lights only) under the Northern Lighthouse Commissioners; those of Ireland under the direction of the Commissioners of the Ballast Office, Dublin; and those of France under the Director-General of Bridges, Roads, and Mines, assisted by Commissioners.

And, under the act 6 and 7 Wm. IV., c. 79, the local or harbour lights, in different places of England and Wales, heretofore under the control and management of commissioners, trustees, &c., are in future to be vested in the Corporation of Trinity House; and the several lighthouses upon the coasts of Scotland and Ireland are to be under their supervision.

By § 44, the Corporation of Trinity House, with their engineers, workmen, &c., may, from time to time, and at all *times, enter* the lighthouses on the coasts of Scotland and Ireland, *respectively, to view the condition* thereof, or otherwise, for the purposes *intended by the act.*

THE PHAROLOGY OF THE ENGLISH AND WELSH COASTS.

*** THE first column contains the name and description of each light. Coast lights, or those of the greatest importance, are in capitals, thus, NORTH FORELAND; Harbour lights, thus, NEWHAVEN; and Tide lights, in italics, thus, *Ramsgate*.

The second column shows the height of the buildings, their situation, &c.

The third column shows, by signs, the description of the light apparatus used, as explained in page 10, section 21, and page 14, sections 43 and 44.

The fourth column shows the minimum height, or that above high water spring tides; and the fifth column shows the distance of the visible horizon from it, with 10 feet added for each height. The sixth shows the date when the light was first shown.

COAST OF ENGLAND.

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
ORFORDNESS. Two bright fixed lights.	Two white towers, N.E. by E. ½ E. and S.W. by W. ½ W., 4,318 feet apart.	● 1a	89 55	12	1792
SHIPWASH LIGHT-VESSEL. One bright fixed light.	N. end of the sand in 4½ fathoms; a red ball, gong, &c.	●	38	10	1837
CORK LEDGE LT.-VESSEL. One bright revolving light every minute.	In 4½ fathoms; a red ball, gong, &c.	●	28	9	1844
HARWICH. Two brilliant fixed lights.	Two white towers, N.N.W. ½ W. and S. by E. ½ E., 653 feet apart.	● ●	69 29	12 9	1818
LANDGUARD FORT.	A temporary bright, red, and green light.				
SUNK LIGHT-VESSEL. One bright fixed light.	In 11 fathoms; a red ball, gong, &c.	●	38	10	1802
GALLOPER LIGHT-VESSEL. Two bright fixed lights.	In 16 fathoms; both lights equal height; two red balls, a gong, &c.	●	38	10	1803
KENTISH KNOCK LT.-VES. One bright revolving light every minute.	In 12 fathoms; two red balls on the same mast; fires a gun when vessels stand into danger; a gong, &c.	●	38	10	1840
SWIN MIDDLE LT.-VESSEL. One bright revolving light every minute.	In 4 fathoms; a red ball, gong, &c.	●	38	10	1837
MAPLIN PILE LIGHTHOUSE. One *red* fixed light. A bright light to S. ½ W.	Painted red; on the S.E. part of the sand; rings a bell in fogs.	2a	36	10	1841
GUNFLEET LIGHT-VESSEL. Two bright revolving lts.	In 9 fathoms.	● ●	38 20	10	1850
MOUSE LIGHT-VESSEL. One bright fixed light.	In 5 fathoms; a red ball, gong, &c.	●	38	10	1838
NORE LIGHT-VESSEL. One bright fixed light.	In 3 fathoms; a red ball, gong, &c.	●	38	10	1734
SEA REACH LIGHTS. One bright fixed light. One bright fixed light.	On Mucking Flat. Off Chapman Head. These lights are red in some directions.	2a 2a	40 40	10 10	1849
GIRDLER LIGHT-VESSEL. One bright revolving light.	In 3½ fathoms at the W. entrance of the Princes Channel; a red ball, &c.	●	38	10	1848
TONGUE LIGHT-VESSEL. One bright fixed light and lower *red* fixed light.	In 4½ fathoms at the E. entrance of the Princes Channel; one red ball, &c.	●	38	10	1848
MARGATE. One *red* fixed light.	A tower 70 feet high on the pier head. Also a small red light at head of the jetty.	●	65	10	1829
NORTH FORELAND. One brilliant fixed light.	A white flint and stone tower, 70 feet high, on the summit of the Foreland.	●	184	18	1636
Ramsgate Tide Light. One red fixed light, while 10 feet.	A granite tower on the S. pier head. A *red globe* on the W. cliff by day, denotes the same. Also two small bright guide lights on the W. cliff.	4a	37	6	

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
GOODWIN LT.-VESSEL. Three bright fixed lights.	Off the N. end of the Goodwin Sands, in 9 fathoms. A red ball at each mast-head, and sounds a gong during fogs.	●	28 42 28	10	1793
GULL STREAM LT.-VES. Two bright fixed lights.	On the W. edge of the Goodwin Sands, in 8½ fathoms. A red ball, gong, &c.	●	14	7	1809
SOUTH SAND HEAD LIGHT-VESSEL. One bright fixed light.	Off the S. end of the Goodwin Sands, in 13 fathoms. A red ball, gong, &c.	●	38	10	1832
SOUTH FORELAND. High lt., bright and fixed. Low lt., bright and fixed.	The high lighthouse, 41 feet high. The low lighthouse, 32 feet high. E. by S. and W. by N., 1,347 feet apart.	1 b ●	372 275	25 22	1793 1842 1795
DOVER BREAKWATER. One *blue* light.	On the end of the Works.				1840
Dover Tide Lights. Three *red* fixed lights, while 10 feet.	1. Two *red* gas lights on the S. pier, 15 feet apart, N. and S. on masts, at 12 feet. 2. One *red* light on the N. pier, at the same period of tide. A flag by day denotes the same.	●	00 12	12 9	1842
Folkestone Tide Light. One fixed bright light, while 10 feet.	From a small white tower on the pier head, at 26 feet above the pier. A flag by day denotes the same.	●	36		1810
DUNGENESS. One bright fixed light.	A *red* tower and buildings on the extremity of the point, 86 feet high.	●	92	14	1789
Rye Tide Lights. Two bright fixed lights, while 10 feet on the bar.	From the Camber, on the N. side of the entrance, N. by W. and S. by E., 540 feet apart.		26 16	4 3	
HASTINGS. One bright, one *red* light.	Upper light bright, in the town; lower, *red*, on the beach, N.N.W. and S.S.E., 508 feet apart, to direct the fishermen (between March 25 and September 29).		60 30	12 9	
EASTBOURNE. A single lamp.	Only during the fishing season.		[illegible]		
BEACHY HEAD. A light revolving in 1 minute, 55 seconds.	A white lighthouse, 20 feet high, on the summit of Belletout Cliff (duration of flash 15 seconds).	●	285	22	1828
NEWHAVEN. 1. A bright fixed light. 2. *Tide Light.* Fixed, *red*, between 10 and 13 feet, bright above 13 feet.	1. On the W. pier. 2. Ditto, 150 feet S. of the former.	●	28 17	8 [illegible]	
BRIGHTON. One green fixed light.	On the chain pier head.		35	10	1824
SHOREHAM HARBOUR. A bright fixed light.	A white tower near the central pier, opposite the entrance to the harbour.	4 a	42	10	1825
Shoreham Tide Light. A *red* light, with 11 feet.	On centre pier, at 750 feet, S.S.W. ½ W. of the former.		23		
ARUNDEL. A fixed *red* light.	From the N. end of the eastern pier at Littlehampton, at 30 feet.	●	30	9	1846
OWERS LIGHT-VESSEL. One bright fixed light.	On the E. end of the Owers Shoal, in 11 fathoms. A ball at the mast-head, sounds a gong during fogs, and has a signal gun.	●	38	10	1788
BEMBRIDGE LIGHT-VESSEL. Two bright fixed lights.	Near the Nab Rock, off Bembridge Point, in 5 fathoms. A ball at the mast-head, sounds a gong, &c.	●	38 28	10 8	1812
ST. CATHERINE'S. One brilliant fixed light.	A handsome stone tower, 105 feet high, on St. Catherine's Point.	1 b	178	18	1840
SOUTH SEA CASTLE. One *red* fixed light.	A pale and strong red light on the Castle.	●	31	9	1822
SOUTHAMPTON. One bright, *one red light.*	*In one, is the leading mark up the Channel.*				1841

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
CALSHOT LIGHT-VESSEL. One bright revolving light in every minute.	Off Calshot Castle, in 3½ fathoms. A ball at the mast-head, sounds a gong, &c.	●	32	9	1842
NEEDLES. One fixed bright and *red* light.	A white tower, 26 feet high, on the Needles Cliff. The light is *red* seaward, but bright towards Hurst Point.	●	469	27	1786
HURST LIGHTS. Two bright fixed lights.	N.E. by E. ½ E. and S.W. by W. ½ W., 755 feet apart. A light in the low lighthouse shows only between W. and W.N W. ½ W.	● ●	66 29	12 9	1812 1786
POOLE. Two *red* lights.	N. ½ W. and S. ½ E., 786 feet apart on N. side of entrance.	●	37 16	6	1848
WEYMOUTH. One *red* fixed light.	On the S. pier head.		23	5	
PORTLAND. High lt., bright and fixed. Low lt., bright and fixed.	On the Bill of Portland. The upper lighthouse white, and 25 feet high. The lower lighthouse white, and 70 feet high, N.N.W. ½ W. and S.S.E. ½ E., 1,509 ft. apart.	● ●	196 131	19 16	1716 1789
TEIGNMOUTH. One *red* fixed light.	A limestone tower on the S.W. end of the Denn.	●	31	9	1845
BRIXHAM. One *red* fixed light.	On an iron stand on the pier head.	●	20		1839
DARTMOUTH. One *red* fixed light.	On St. Petrox Point, on the W. side of entrance. (*Except* in June, July, and August.)		49	7	1837
START POINT. One brilliant revolving lt., visible every minute. (A faint continuous lt., within 10 miles.)	A white tower, 94 feet high, at 140 yards inside the S.E. extremity of the point. A fixed light is also visible from the tower, when it bears S. of W.S.W.	1 b	204	19	1836
PLYMOUTH BREAKWATER. One fixed bright or *red* light.	A granite tower on the W. end of the breakwater. The light is bright to seaward, but *red* E. of the bearing of N.E. ½ E. from it. A bell during fogs.	2 b	63	9	1844
PLYMOUTH HARBOUR. One bright fixed light.	A tower, 20 feet high, on the W. barbican pier head.	●	29	6	1822
EDDYSTONE. One brilliant fixed light.	An admirable white stone tower, 76 feet above the foundation on the rock, which covers 14 feet at high water.	2 a	72	13	1759
FALMOUTH. One revolving light in 20 seconds.	A white tower, 40 feet high, on St. Anthony's Point.	●	65	12	1835
LIZARD. Two brilliant fixed lights.	Two white towers, each 45 feet high, W. ¾ N. and E. ¾ S., 223 feet apart, on the Lizard Cliff.	● ●	E 221 W 224	20 20	1751
Penzance Tide Light. A bright fixed light, while 10 feet.	A white building, 22 feet high, on the pier head.	●	29	9	1817
LONGSHIPS. One brilliant fixed light.	A white square tower, 36 feet high.	●	88	14	1795
SEVEN STONES LT.-VES. Two bright fixed lights.	On the E. side of the rocks, in 40 fathoms. Sounds a gong during fogs.	●	30 38	10	1841
SCILLY. One bright revolving light every minute.	A white tower, 53 feet high, on the summit of St. Agnes' Island.	●	138	16	1680
BISHOP ROCK. Erecting.					
NEW QUAY.					
St. Ives Tide Light. One bright fixed light, while 10 feet.	On the pier head.	●	23	7	1831
Hayle Tide Lights.	N. 25° E. and S. 25° W., 297 feet apart, while 12 feet water.	●	81 60	6	1840

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
TREVOSE HEAD. Two bright fixed lights.	The lower light is 50 feet to seaward of the upper.	1 b 1 b	204 129		1847
LUNDY ISLAND. Upper lt., revolv. in 2 min. Lower fixed light, from N. by W. to S.W.	In one tower, 89 feet high, on the ridge of the island.	1 d ●	540 470	30	1820
Bideford Harbour. Two bright fixed lights.	In one, S. 47° E., they lead over the bar, from half flood to half ebb.	●	86 40	14 11	1820
ILFRACOMBE. One *red* fixed light.	From the Lantern Hill (Michaelmas to Lady-day).	●	100	15	
BURNHAM. Upper light, intermitting 4 minutes. Lower light fixed.	Upper tower white; lower with black streak, E.S.E ¼ E., 1,500 feet apart. Upper light bright, 3½ minutes, obscured, ½ min.	●	91 23	16 12	1832
AVON. One bright fixed light.	A white tower, 65 feet high, on the E. side of Bristol Channel.	2 b	70	13	1840
ENGLISH AND WELSH GROUNDS LIGHT-VESSEL. One bright revolving light every minute.	In 6 fathoms, a red ball, gong, &c.	●	38		1838
FLATHOLM. One bright fixed light.	A white tower, 77 feet high, on the S. point.	1 b	156	17	1737 1839
USK. One bright fixed light.	W. side of the entrance to the river; a *red* light is shown up the river.		39	10	1821
CARDIFF. Building.	On the pier.				1851
NASH POINT. Two bright fixed lights.	Two white towers, 1,000 feet apart, S.E. by E. ¼ E. and N.W. by W. ¾ W.		167 122	18 16	1832
Swansea Harbour. One *red* fixed tide light.	On the W. pier, while 8 feet water.	●	28	9	[illegible]
MUMBLES. One bright fixed light.	A white tower, 56 feet high, on the Head	●	114	15	1798
HELWICKS LIGHT-VESSEL. One bright revolving light every minute.	In 16 fathoms, off the W. end of the Sand, a red ball, gong, &c.	●	38	10	1846
Llanelly Tide Light. One fixed light.	On S. end of breakwater, from half-flood to quarter-ebb.				1850
Pembrey Harbour. One *blue* or *red* fixed light.	While 10 feet water; it is *blue* to W., and *red* toward Llanelly.	■	35	9	
CALDY ISLAND. One brt. or *red* fixed lt.	A white tower, 40 feet high; the E. limit of the *red* light clears the Helwick Sand.	●	210	19	1829
ST. ANNE'S POINT. Two bright fixed lights.	Two white towers, 44 and 17 feet high, 610 feet apart, N. by W. ¼ W.	● ●	192 159	19 17	1714 1800
SMALLS. One bright fixed light.	A timber structure, painted *red*, 58 feet high.	●	70	[illegible]	1778
SOUTH BISHOP ROCK. One bright revolving light in 20 seconds.	A white tower, 36 feet high.		144	16	1839
Aberystwith. Two fixed lts. occasionally.					
BARDSEY ISLAND. One bright fixed light.	A square tower, 79 feet high.	1 b	120	17	1821
CARNARVON. One *red* fixed light.	On Llanddwyn Point; a black ball, while 10 feet water.	●	50	15	1845
SOUTH STACK ROCK. One bright revolving light every 2 minutes.	A white tower, 59 feet high. During fogs a revolving light is shown at 40 feet.	●	201	19	1809
HOLYHEAD HARBOUR. One bright fixed light.	On the pier head; a *red* light is also shown to N.N E.; a bell in fogs.	●	44	11	1820
SKERRIES. One bright fixed light.	A white tower, 54 feet high, on the highest island.	1 b	117	15	1714

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
Almwch Port. One bright fixed light.	On the N. pier, not shown when vessels cannot enter.	●	26	9	1817
LYNUS or ELIAN POINT. One intermitting light, visible 8 seconds, obscured 2 seconds.	A white castellated building, 36 feet high.	●	126	16	1835
Menai. One *red* fixed light.	On Trwyn Du Point.	1 b	61	10	1837
AIR POINT. One bright or *red* fixed lt.	A pile lighthouse; the light is *red* only over the Hoyle Sand; a bell in fogs.		42		1844
LIVERPOOL N.W. LIGHT SHIP. Three bright fixed lights	In 7 fathoms in the bay, burns a *blue* light every 2 hours, a flag by day, a bell in fogs.	●	36	10	1814
Hoylake. Two bright fixed lights.	In one, S.W. ¾ S., 1,200 feet apart.	●	71 47	13 11	1763
BIDSTON. One bright fixed light.	A stone tower, 50 feet high, on the hill.	●	300	23	
Leasowe. One bright fixed light.	On the shore.	●	118	14	
Black Rock. One revolving light every minute, bright and *red*.	A white tower, 75 feet high, at the entrance of the Mersey.	●	88	14	1830
Crosby Light-Vessel. One bright fixed light.	In 40 feet off the E. elbow of the Burbo Bank; a red ball.	●			1840
Formby Light-Vessel. Two fixed lights.	In 2 fathoms; a red ball.	●		8	1834
Formby Old Lighthouse. One *red* fixed light.	On the point.	●	82	12	1834 1851
Ribble River. Upper, bright; lower, *red* fixed light.	In the same tower on Stanner Point.	●	72 35		1848
Lytham Harbour. Occasional tide light.	When required by vessels entering.	●			
Fleetwood. Two bright fixed lights.	Upper lighthouse red, lower, stone colour, N. and S., 850 feet apart.	●	90 30		1841
Wyre River. One bright fixed light.	A pile lighthouse, painted red; a bell in fogs.		30	10	1840
Lune River. Two bright fixed lights.	On Cockerham Point, shown while 8 feet water.	● ●	54 20	9	1847
WALNEY ISLAND. One bright revolving light every minute. One *red* fixed light.	A stone tower, 60 feet high, on the S. point.	●	60	13	1790
ST. BEES HEAD. One bright fixed light.	A white tower, 33 feet high.	■	333	23	1718
Whitehaven. 1. One revolving light, every two minutes. 2. *One fixed tide light.*	1. A white tower, 37 feet high, on the pier. 2. From half flood to half ebb, S.S.E. and N.N.W., 200 yards, with the former.		47	11	1821
Harrington Tide Light. One fixed light.	On a mast on the pier head, while 8 feet water.	●	44	11	1797
Workington Tide Lights. Two fixed lights.	On the ends of St. John's and Wooden piers, S. and W., 310 yards apart, while 8 feet water; that on St. John's pier shows a half circle of *red* light towards Salterness Point.		63	11	1835
Maryport Tide Light. One fixed light.	On the S. pier, while 8 feet water. A red flag by day.		51	10	1796
Solway Light-Vessel. *One red light.*	In 4½ fathoms, in the Robin Rigg Channel. Black ball, a bell in fogs.	●	25	6	1841

Name and Description of Light.	Situation, &c.	Description of Apparatus	Height above High Water.	Visible in Miles.	Year erected.
LEE SCAR. One bright fixed light.	On piles on the rocks.		25	6	1841
SKINBURNESS. One *red* light.	A white wooden building, 32 feet high, on Silloth Point.		40	9	1841
Carlisle Port Tide Light. A lamp light.	On the pier head, a flag by day.				1841
ISLE OF MAN.					
POINT OF AIR. A revolving light, bright and *red* alternately, every 2 minutes.	A stone tower, 84 feet high.	●	106	15	1818
PEEL HARBOUR. One bright fixed light.	On the E. side of the entrance.		21	6	1811
CALF OF MAN. Two bright revolving lights every 2 minutes.	Two stone towers, 55 and 40 feet high, 580 feet apart, N.E. ½ E. and S.W. ½ W.		375 282	25 23	1818
PORT LE MURRAY. One bright fixed light.	On the S. side of the entrance.	●	25	18	1812
CASTLETOWN HARBOUR. One fixed light.	During the herring fishery, or when required.		22	6	1765
DERBY HAVEN. One fixed light	During the herring fishery, or when required.		50	11	1650
DOUGLAS. One bright fixed light.	A brown stone tower, 65 feet high, on Douglas Head.		104	15	1832
DOUGLAS HARBOUR. One fixed light.	On the N. pier head.		34	10	1796
RAMSEY HARBOUR. One fixed light.	On the S. side of the entrance.	●	35	10	1800
BAHAMA BANK LT.-VES. Two bright fixed lights.	In 9 fathoms, on the S.E. part of the bank. Two red balls, a gong, &c.	●	20 38	10	1848

REMARKS ON THE LIGHTHOUSE OF LUNDY ISLAND.

The loss of the *Jeune Emma*, of Cherbourg, in 1828, by mistaking Lundy Island for that of Ushant, and that of the *Elizabeth*, in 1833, by mistaking the same light for that of Cape Clear, have induced us to insert a few remarks on it.

The particulars of the *Jeune Emma* will be found in the Observations on Currents hereafter. The *Elizabeth*, a ship of 600 tons, belonging to Liverpool, was returning to that port from Calcutta, with a rich cargo, in December, 1833; but, as reported, mistaking the Lundy for the Cape Clear lights, she was wrecked in the night on the South tail of Bideford Bar. Happily the crew were saved.

Let it be recollected that the tower of Lundy exhibits *two distinct lights;* the upper revolving, without any interval of total darkness, all round the circle; the lower one faces the West, and exhibits a fixed and steady light over 90 degrees of the horizon only, or from N.N.W. to W.S.W. by compass. The land on which the lighthouse is erected is so high, that the upper light is 542 feet above the mean level of the sea; the lower light, 470 feet. There are four lights in the lower lantern: but it has been noticed that, at a certain distance from the island to the westward, the whole appears like *one very strong revolving light.* This should be generally known; and also, that if there be any haze in the Channel, the lights are often invisible; for, from the great elevation of the lights, it happens, at times, in moderately clear weather, that the island may be seen when the lights are obscured in the atmosphere.

2. ISLANDS AND COASTS OF SCOTLAND.

	LAT. N.			LON. W.			AUTHORITIES.
	°	′	″	°	′	″	
EDINBURGH; the Observatory .... [1]	55	57	23	3	10	45	
East Lomond.................	56	14	31	3	13	10	
Fifeness	56	17	0	2	34	40	
Bell Rock Lighthouse	56	26	3	2	23	6	
Dundee Law	56	28	41	2	58	26	
Button-ness; High Light...	56	28	7	2	44	53	
Aberbrothie; the Abbey ...	56	33	45	2	34	53	
Red Head	56	36	55	2	29	24	
MONTROSE; Round Tower	56	42	5	2	26	6	
——— Spire	56	42	31	2	27	51	
ABERDEEN; Marischal College	57	8	57	2	5	42	THE GRAND TRIGONOMETRICAL OF ORDNANCE SURVEY of Great Britain, under the direction of COLONEL COLBY, to 1835.
Old Aberdeen; Northern blunt Spire..................	57	10	11	2	6	3	
Belhelize or Orrock; Dovecote	57	15	52	2	3	57	
Buchan-ness Lighthouse ...	57	29	15	1	47	0	
Peterhead; Old Mill	57	30	43	1	47	31	
Battery Head; Pile	57	36	52	1	50	39	
Fraserburg Lighthouse, on Kinnaird Head	57	41	51	2	0	6	
Troup Head; Staff	57	41	36	2	17	38	
Macduff; Spire...............	57	40	5	2	30	0	
TARBETNESS; Lighthouse	57	50	56	3	46	25	
Duncansby Head; Station	58	40	22	3	1	7	
ORKNEY.—Pentland Skerries Lights	58	41	10	2	55	2	
Stromness Church	58	57	49	3	23	41	
Start Point of Sanda; Lighthouse	59	16	30	2	30	0	
Fair Island; summit ...	59	32	54	1	37	50	
Foul Island; summit (1,369 feet)	60	8	28	2	5	40	
SHETLAND. — Sumbro Head Lighthouse...[2]	59	51	20	1	16	27	
Brassa Island; summit (742 feet)	60	7	51	1	5	49	
LERWICK; the Fort Flagstaff........................	60	9	22	1	8	41	The OBSERVATIONS of Mr. GEO. THOMAS, R.N., on his Survey of Shetland, &c., 1825 to 1833.
GardieHouse onBrassa[3]	60	9	24	1	7	40	
Whalsey Island; summit	60	20	1	1	0	22	
Brury Isle, Out Skerries	60	25	41	0	45	2	
Yell Isle; Reafrith Kirk	60	35	55	1	3	46	
Strandburg Ness, Fetlar	60	33	51	0	33	36	
Fetlar Isle; summit (521 feet)	60	37	12	0	51	56	
Haaf Gruna; summit...	60	39	44	0	50	24	
Balta Island; summit ...	60	45	3	0	47	17	
Lambaness, on Unst......	60	49	0	0	45	40	
Burraford Holms	60	51	0	0	53	30	
Ramna Stacks	60	39	36	1	18	40	
Ve Skerries, off St. Magnus Bay	60	22	30	1	49	10	
Fugloe Skerry, near Papa	60	20	15	1	45	0	
Scalloway Castle	60	8	31	1	16	25	

ISLANDS AND COASTS OF SCOTLAND—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
WESTERN COASTS OF SCOTLAND.			
Cape Rath; Lighthouse ...	58 36 35	4 58 20	Captain Huddart's Survey of the Western Islands, &c., with a trifling correction.
Loch Laxford; Entrance...	58 24 0	5 4 20	
Stornoway in Lewis	58 12 20	6 20 0	
Ullapool in Ross ....[4]	57 53 30	5 3 30	
Glash or Scalpa; Lighthouse	57 50 20	6 37 30	
Lock Nawaddy; Entrance	57 34 20	7 5 0	
Barra Head Lighthouse ...	56 47 20	7 35 0	
Tobermorey, in Mull.........	56 38 0	6 2 20	
Mull of Cantire; Lighthouse	55 20 0	5 43 30	
Campbell Town	55 25 0	5 36 30	
St. Kilda ....[5]	57 49 30	8 32 30	Mr. Lamont and Capt. Huddart.

NOTES.

1. EDINBURGH.—For the positions of places in the East of Scotland, southward of Edinburgh, the reader is referred to our "Sailing Directory for the North Sea," 7th Edition, 1842. Of the Astronomic Observatory at Edinburgh, the longitude appears to have been finally settled, in 1839, by Professor Henderson, who gives it as 12′ 43″, or 3° 10′ 45″, in lieu of the previous statement, 3° 10′ 54″.

2. SHETLAND.—We have given the several points of Shetland, in the Table, on the authority of Mr. Thomas, one of the most accurate and experienced surveyors of the British Navy. There have been singular variations on these points, and the names of Kerguelen, Lovënorn, Donelly, and Brodie, have successively been mentioned, in connexion with the longitude of Lambaness, which has been reported from 0° 15′ to 0° 59′; now happily settled as 0° 45′ 40″ W.

3. LERWICK, &c.—Captain *John Ross*, in the narrative of his voyage, 1818, gave the longitude of *Gardie* House, on Brassa, from the mean of his chronometers, as 1° 15′ 52″, which *caused a removal of all the islands in the charts to a situation too far to the West;* but the error can now be corrected, as Gardie House is in 1° 7′ 40″ only, and Lerwick in 1° 8′ 41″; not as formerly given, in 1° 18′ 0″ W.

4. WEST OF SCOTLAND.—For the Western Coasts and Islands of Scotland, we have made use of the Survey by Captain Huddart, a chart exhibiting the data on which it has been composed. This survey was carried on, as stated by the author, "from observations made at Campbell Town, Tobermorey, Cana, Ullapool, Laxford, Stornoway, Glash, Namaddy, and Barra, to determine the latitude and longitude by astronomical instruments and chronometers; from which a series of triangles, determined from the true meridian, was carried on, to find the situation of the intermediate places and remarkable objects, as data for laying down the soundings," &c., and in the comparison he had not to correct any of the above-mentioned places more than above half a statute mile.

5. ST. KILDA.—In July, 1806, Mr. Lamont, jun., surveyed the Islands of St. Kilda, Borea, &c. His results agree very well with Captain Huddart's. A general southerly current prevailed during the whole 20 or 21 days he remained on and about the islands; and is known to prevail during summer. St. Kilda is said to be visible from the hills of Skye, in very clear weather.

A Description of *St. Kilda*, the *Flannan Isles, Barra*, *Rona*, *&c.*, is given in our "*Memoir and Directions for the Northern Ocean*," pages 12 to 16.

VARIATIONS OF THE COMPASS.—In the Frith of Forth the variation was 28° 15′ W. in 1815; at Fetlar, Shetland, Mr. Thomas found it to be 28° 16′ W. in 1827; at Balta, 28° 26′. In 1833, on the West of the islands, 28° 30′; on the East, in lat. 60° 15′, 27° 40′; at the Pentland Skerries, 29° 19′, in 1830; near Cape Rath, in 1819, it was 30° W.: at St. Kilda, in July, 1806, Mr. Lamont, jun., found it to be 31½° W. Near the high rock, named *Rokol*, in lat. 57° 39′, lon. 13° 31′, it was about 33° in 1810.

THE PHAROLOGY OF THE COASTS OF SCOTLAND.

(The table, and the signs in the *third* column, are explained on page 16.)

Name and Description of Light.	Situation, &c	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
INCHKEITH. One bright revolving light every minute.	A white tower, 45 feet high.	1d	220	18	1804
FISHERROW.	On the pier head; all night, except in moonlight.	●	20	5	1839
Leith. Two fixed lights; inner, bright; outer, *red*.	On the eastern pier; while 10 feet water, N. ½ W. and S. ½ E., 500 yards apart.	●	22	7	1758 1829
Newhaven. One *red* light.	On the pier; occasionally.		15	5	
GRANTON. One *red* fixed light.	On the pier head.		40	6	1845
BURNT ISLAND. One fixed light.	On the eastern pier; occasionally (also a *red* light at Newhaven, and a bright one at Queen's Ferry, for the use of the passage boats).		20	8	1845
GRANGEMOUTH. One fixed light.	At the entrance of the River Carron.	●	33	10	1847
KIRKCALDY. One fixed light.	On the N.E. side of the entrance; also a small light at the pier head.		20	[illegible]	
ANSTRUTHER. Two *red* lights.	N.E. ½ N. and S.W. ½ S. from each other.		20		1848
ISLE OF MAY. One brilliant fixed light.	On the summit of the island.	1b	240	21	1804
ISLE OF MAY LEADING LT. One bright fixed light.	At 43 yards S.S.W. ¾ W. of the upper light; must not be open to westward.	2b	110	15	[illegible]
BELL ROCK. One revolving light, bright and *red* alternately every 2 minutes.	A tower 100 feet high; on the Bell Rock, at 10 feet below high water. A bell is sounded every half minute in fogs.	●	90	14	1811
ST. ANDREW'S. Two fixed lights. One fixed light.	1. On the pier head, N.W. and S.E. 2. On a turret in Cathedral wall.	● ●	30 100	6 5	1825 1849
BUDDONNESS or TAY. Two brilliant fixed lights.	Two white towers on the Ness, 70 and 50 feet high. The lights in one, N.N.W. and S.S.E., 374 yds. apart, lead into the Tay.	● ●	85 65	14 12	1820
PORT ON CRAIG. Two fixed lights.	Leading lights up the Tay. N.W. by W. ¾ W. and S.E by E. ¾ E., 540 yards apart. A bell in fogs.	●	60 35	12 11	1820 1845
NEWPORT. Two fixed lights.	On the W. Ferry pier, N.N.E. and S.S.W. 63 yards apart.	●	10 16	7 6	
DUNDEE HARBOUR. Two fixed lights.	On middle and eastern piers, N.W. ¾ W. and S.E. ¾ E., 130 yards apart.	●	10 12	7	1827
ARBROATH. One *red* fixed light.	On the N. pier, when vessels enter.	●	24	8	1826
MONTROSE. Two fixed *red* lights.	On the N. side of the entrance, N.W. by W. ¼ W., and S E. by E ¼ E., 303 yards apart; in one they lead in.	●	60 35	10	1818
STONEHAVEN. One bt., one *red* fixed lt.	On the pier, W. by N. ¼ N., and E. by S. ¼ S.	●	18 24	12	1839
GIRDLENESS. Two bright fixed lights.	In one tower.	1b	185 115	19 16	1833
Aberdeen. One bright fixed light. Two *red* (or *green*) fixed lights.	On the N. pier head, from half flood to high water. When the entrance is safe these are *red*: when ships cannot enter they are *green*. In one, W. by S. ¼ S., they lead in.		40 47 30	8 3	1842

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
BUCHANNESS. One fixed light, flashing every 5 seconds.	A stone tower, 100 feet high, on the Ness or Boddom Point.	1 f	130	16	1827
PETERHEAD. A small *yellow* light.	On the pier head, S. harbour, during the herring fishery, July 15 to September 15.		21	3	1834
FRASERBURGH. Two fixed lights.	On the pier head.		34 16	5	1841
KINNAIRD HEAD. One bright fixed light.	A stone tower, 57 feet high, on the head.	●	120	15	1787
MACDUFF. One *red* fixed light.	On the pier head.	●	25	6	1829
BANFF. One *red* fixed light.	On Brae Head.	●	80	14	1832
COVESEA SKERRIES. One revolving light every minute, part bt., part *red*.	On Craighead. It is *red* from S.E. by E. ½ E. to S.E. ½ S. The rest is bright.	1 b	160	18	1846
CHANONRY POINT. A bright fixed light.	A tower, 31 feet high, on the point.	●	40	11	1846
CROMARTY POINT. One *red* fixed light.	A tower, 31 feet high, on the point.	●	[illegible]	9	1846
TARBETNESS. One *intermittent* light every 3 minutes.	Bright 2½ minutes, suddenly eclipsed for half minute; within Moray Frith it is permanently visible.	●	175	18	1830
WICK OF PULTENEY TOWN. One *red* light.	On the pier head, during August and September.		25	3	1837
NOSSHEAD. One revolving light every half minute.	From N.E. ¾ N. to W.N.W. the light is *red*, the rest, to seaward, is bright.	1 d	175	15	1849
DUNNETHEAD. One bright fixed light.	A stone tower on the northernmost point of Scotland.	●	346	23	1831
PENTLAND SKERRIES. Two bright fixed lights.	Two stone towers, 30 and 10 feet high, N.N.E. and S.S.W., 100 feet apart.	● 1 b	170 140	18 16	1794
HOY SOUND. High light, *red* or white. Low light, bright.	A tower, 90 feet high, on the E. point of Graemsay Island. The light is *red* toward Hoy Sound, but white between S.S.E. and W.S.W.		115	10	1851
	On the N. point, N.W. ½ W. 2,237 yds. from the high lt. In one they lead into Stromness.		55	7	1851
KIRKWALL. One bright fixed light.	On the pier head, from August to April.		20		1838
START POINT. One bright revolving light every minute.	A stone tower, 80 feet high.	●	100	15	1806
NORTH RONALDSHA. One bright fixed light.	Building.				1851
SUMBURGH HEAD. One bright fixed light.	A stone tower, 35 feet high, on the S. point of Zetland.	●	300	22	1812
CAPE WRATH. One revolving light, alternately bright and *red* every 2 minutes.	A white tower, 50 feet high.	■	400	25	1828
STORNOWAY. Building.	On Arnish Point, Lewis Island. Building.				1836
ISLAND GLASS. One bright fixed light.	A stone tower, 80 feet high, on the N.E. part of the island.	●	130	16	1789
BARRA HEAD. One *intermittent* light every 3 minutes.	A tower, 55 feet high, on the highest part of Bernera Island. Bright 2½ minutes, suddenly eclipsed for half a minute.	●	680	33	1833
SKERRYVORE. One brilliant revolving light every minute.	A noble stone tower, 138 feet high; the eclipses are not total when near the light.	1 e	150	18	1844

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
ARDVISHAIG. One bright fixed light.	A stone tower on the pier head.		25	4	[illegible]
ARDNAMURCHAN. One bright fixed light.	A stone tower, 100 feet high, on the point.	●	180	18	1849
LISMORE. One bright fixed light.	A white tower, 70 feet high, on Mousedale Island.	■	96	15	1833
PORT ELLEN or LOCH LEODAMIS. One bright fixed light.	On Slate Quarry Point, at the entrance of the harbour.	■	60	11	1833
RHINS OF ILAY. One bright light, flashing every 5 seconds.	A stone tower, 80 feet high, on Oversay Island, off Ilay.	1 f	150	17	1825
MULL OF KINTYRE. One bright fixed light.	A stone tower, 28 feet high, on the S.W. head of Kintyre.	●	297	22	1787
SHIP ROCK OF SANDA. One fixed *red* light.	A stone tower, 80 feet high, on the highest point.	3 ▲	165	15	1850
CAMPBELTON or KILKERRAN. One fixed light. One *red* light.	On the beach in the Loch. A lamp on the N. pier head, *red* when bearing N.W.	●	36 12	6	1824
PLADDA. Two bright fixed lights.	In the same tower, which is 80 feet high, on the island off the S.E. point of Arran.	●	130 77	16 13	1790
CUMBRAY. One bright fixed light.	On the W. side of Little Cumbray Island.	●	115	30	1757 1793
TOWARD POINT. One bright revolving light every minute.	A white tower, 50 feet high, on the point.	●	55	11	1812
CLOCH POINT. One bright fixed light.	A white tower, 76 feet high.	●	76	13	1797
GREENOCK. Two *red* fixed lights. One fixed light.	About ¾ of a mile below Greenock. In one E.N.E. ¾ E. 140 yards apart. A lamp on the Custom House Quay.	● ●	40 25	6 4	1834 1829
PORT GLASGOW. One small *red* light.	On the W. Quay, to show the entrance.		18	3	
CARDROSS. One *red* light.	On the Pillar Bank.		22	4	1849
BOWLING BAY. A small light. One *red* light.	E. entrance of Forth of Clyde Canal. On Donald's Quay. (Three lights between Port Glasgow and Bowling Bay—at Auchenlech, Garmoyle Light-vessel, and Dickies Light.)		11 20	2 4	1849 1849
ARDROSSAN. Two *red* fixed lights.	One on N. end of Breakwater, one on N.E. end of Quay, E. by N. and W. by S., 250 yards apart.		[illegible] [illegible]	4	1840
SALCOATS. One fixed light.	On the pier, *red* light, but bright while in the fairway.	●	26	6	[illegible]
TROON HARBOUR. One interm. light, visible 40 sec., eclipsed 20 sec. One *red* fixed light.	Inner end of pier. Pier head, N.E. ½ N. and S.W. ½ S., 350 yards apart.	● ●	35 35	9 6	1827 1848
AYR HARBOUR. One bright, one *red* fixed light. *Tide light* bt. and fixed.	On the N. pier in one tower. While 8 feet on the bar, S.E. by E. and N.W. by W. ½ W., 283 yards, with the former.		12 to 53	10 4	1790 1826
LOCH RYAN. One bright fixed light.	A stone tower, 24 feet high, on Cairn Ryan Point.	■	30	10	1847
CORSEWALL. One rev. lt. every 2 min., bt. and *red* alternately.	A stone tower, 92 feet high, on the W. side of the entrance to Loch Ryan.	■	112	15	1817
PORT PATRICK. One bright fixed light.	On the inner end of the S. pier.	●	38	9	1790

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
MULL OF GALLOWAY. One bt. interm. light, bt. 2½ min., eclipsed ½ min.	A stone tower, 70 feet high, on the point. The light changes suddenly.	●	310	23	1830
LITTLE ROSS. A bright light flashing every 5 seconds.	A stone tower, 58 feet high.	1 f	175	18	1843
SOUTHERNESS. One bright fixed light.	A square white tower, 50 feet high, on the point.	■	50	11	1805
Annan River Tide Light. One fixed light.	On Barnkirk or Annan Foot. A flag by day.	●			1841

3. COASTS OF IRELAND, ETC.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
THE NORTHERN COAST.			
Tory Island; Lighthouse	55 16 27	8 15 19	
Fannet Point; Lighthouse	55 16 34	7 38 6	
Innistrahul; Lighthouse	55 25 54	7 13 51	
Innishoen Head; Lighthouse	55 14 20	6 56 0	
Magilligan Tower, L. Foyle	55 11 32	6 57 58	
Port Rush	55 12 30	6 40 15	
Bengore Head [1]	55 15 0	6 29 35	
Rachlin Isle; Church	55 17 35	6 12 2	
——— N.E. point	55 18 0	6 10 40	
KnocklaidMountain(1690ft.)	55 9 42	6 15 13	
Fair Head	55 13 30	6 9 30	
THE EASTERN COAST.			
Tor Point	55 11 50	6 4 10	
Garron Point	55 3 0	5 58 30	
TheMaidens; EasternLight	54 55 30	5 44 10	
Hunter Rock (9 feet)	54 52 45	5 45 30	The Surveys of Captain WM. MUDGE, R.N., F.R.A.S., made in co-operation with the Grand Trigonometrical Survey of Ireland, 1828-1830.
Black Head	54 46 0	5 42 0	
Carrickfergus	54 42 35	5 49 15	
BELFAST; Mouth of the Lagan	54 36 0	5 56 0	
——DivisMount(1800ft.)	54 36 39	6 1 17	
Bangor Castle	54 39 20	5 40 40	
Copeland Lighthouse	54 41 43	5 31 34	*** THESE SURVEYS, put forth without the slightest tincture of ostentation, are of the most valuable description. The statement from them, hereto annexed, enables a commander from BELFAST, or any other given port, to commence his Journal with confidence, being assured that his first point of departure may be relied on, as *positively correct*.
Donaghadee; Pier Head	54 38 38	5 32 25	
Ballyhalbert; Fort	54 29 30	5 28 10	
South Rock Lighthouse	54 23 55	5 25 18	
St. John's Point	54 13 20	5 40 0	
Slieve Donard (2797 feet)	54 10 48	5 55 26	
Carlingford Lighthouse	54 1 11	6 4 55	
———— Hill (1580 feet)	54 2 39	6 13 9	
Clogher Head	53 47 40	6 14 0	
Drogheda; centre	53 42 50	6 22 0	
Balbriggan Light	53 36 46	6 10 53	
St. Patrick's Island	53 34 45	6 5 20	
Lambay Island; summit	53 29 20	6 2 0	
Howth Hill; peak (565 ft.)	53 22 23	6 4 20	

COASTS OF IRELAND, ETC.—continued.

	Lat. N.	Lon. W.	Authorities.
	° ′ ″	° ′ ″	
Poolbeg Lighthouse	53 20 30	6 9 16	The Surveys of Captain Wm. Mudge, R.N. F.R.A.S., made in co-operation with the Grand Trigonometrical Survey of Ireland, 1828—1830.
DUBLIN; Nelson's Pillar [2]	53 21 0	6 16 45	
Kingstown; Lighthouse	53 18 5	6 9 0	
Wicklow Head Light	52 57 53	6 0 20	
Roslare Sand Hill	52 19 45	6 22 21	
Tuskar Lighthouse	52 12 7	6 12 38	
The Southern Coast.			
Saltees Light-vessel	52 2 18	6 38 15	The Grand Trigonometrical Survey of Ireland, and the Surveys of the late Capt. Mudge.
Coningmore Rock	52 4 45	6 37 49	
Hook Lighthouse, near Waterford	52 7 25	6 55 58	
Helwick Head	52 3 6	7 32 40	
The Mount Knockmeldown	52 13 33	7 55 0	
Roche Point; Lighthouse	51 47 20	8 16 32	
Robert Head	51 43 55	8 20 0	
Kinsale; Southern Light	51 36 45	8 32 0	
Stags of Castlehaven	51 28 15	9 13 46	
Cape Clear; Lighthouse [3]	51 26 3	9 29 0	
Fastnet Rock	51 24 0	9 36 15	
Crookhaven; Lighthouse	51 28 35	9 42 31	
Mizen Head	51 27 15	9 50 0	
Mount Gabriel	51 33 30	9 32 0	
Sheep Head	51 32 55	9 51 40	
Hungry Hill, pyramid (2240 feet)	51 39 3	9 45 19	
Roanharric R. in Bantry Bay	51 41 5	9 47 6	
Signal Tower, Bear Island.	51 37 43	9 53 40	
The Western Coast.			
Dursey Island, South Point	51 35 5	10 14 10	
Bull Rock [4]	51 36 0	10 18 0	
Skelligs; Lighthouse	51 46 5	10 32 0	
Valentia Isle; Fort Cromwell	51 55 55	10 18 34	
Doulus Head [4]	51 57 6	10 19 0	
Dunmore Head, Dingle Bay	52 6 3	10 29 0	
Foze Rock	52 1 0	10 39 40	
Inishtuiskero Island	52 7 20	10 34 30	*** The results of the Townland Survey of Ireland are in course of publication; the Northern Counties have already appeared; the Western and Southern portions are in progress.
Kilcradan Head; Lighthouse	52 34 47	9 42 34	
Scattery Island; Round Tower	52 36 42	9 31 15	
Loop Head; Lighthouse	52 28 45	9 56 5	
Mutton Island; Lighthouse	53 15 14	9 3 26	
Slyne Head; Lighthouse	53 23 46	10 16 22	
Clare Island; Lighthouse	53 49 40	9 59 30	
Achil Head	53 58 20	10 16 0	
Eagle Island; Lighthouse	54 16 40	10 5 45	
Telling or Teelin Head	54 40 30	8 46 10	
Ballyshannon Church	54 30 11	8 11 47	
Slieve League (*summit* 1979 feet)	54 39 5	8 42 38	
Bloody Farland (*summit* 1060 feet)	55 8 14	8 15 41	
Muckish Hill; Eastern part (2202 feet)	55 6 21	7 59 49	

NOTES.

1. Bengore Head and Ballycastle.—In Dr. Beaufort's Memoir, Bengore Head is given as in 55° 15′, and Ballycastle as in 55° 12′, from the observations of the Rev. W. Hamilton. Captain Livingston, from particular observations made by him, on passing, says, that Fair Head does not lie more to the northward than 55° 10′. All this is now verified by Captain Mudge's Survey.

The Book of Directions, published by Mr. Laurie, to accompany the Chart of St. George's Channel, with all the Coasts of Ireland, contains a particular description of Bengore Head, and of that stupendous curiosity, the Giant's Causey, forming the western side of it. The mariner should know that these huge columns of basalt abound in ferruginous matter, which, on a near approach, derange the compass in all directions. Fair Head, to the eastward, is similarly constructed; and among the innumerable basaltic columns at this celebrated promontory, is a quadrangular prism, 33 feet by 36 on the respective sides, and upwards of 200 feet in height. This column is supposed to be of the largest dimensions of any single shaft in the world. The depth of water near the cape is such, that vessels of considerable burden can ride within a cable's length of it.

2. Dublin.—The Astronomic Observatory, 3 miles to the N.W. of Dublin, stands in lat. 53° 23′ 13″, and lon. 6° 20′ 30″, as shown in the "*Nautical Almanac*," 1838-40.

3. Cape Clear.—The position of Cape Clear appears, at length, to be satisfactorily ascertained. We had occasion to show, in our former editions, the uncertainty, with regard both to the latitude and longitude, of this important point; and it may still be proper to notice that the latitudes formerly given, by different observers, varied from 51° 19′ (that of Mackenzie and the requisite tables) to 51° 28′. The longitudes, in like manner, varied from 9° 23′ to 9° 40′. Admiral Knight, in 1800, when captain of the *Montague*, gave the latitude as 51° 25′, and the longitude as 9° 30′: this, it will be seen, varies only one minute, and that in longitude, from the result of the late observations; an instance of accuracy very honourable to its author. The lighthouse near this cape is noticed hereafter.

4. Dursey Island, &c.—It has been fully ascertained that the S.W. coasts of Ireland have been laid down in the Surveys of Mackenzie, &c., too far to the South. By a paper, printed for the Hydrographic Office at the Admiralty, in 1801, entitled "Remarks on the S.W. and N.W. Coasts of Ireland, by Lieutenant *T. G. Shortland*, of H.M.S. *Melpomene*," it appeared that, on making Dursey Island, off Bantry Bay, this gentleman observed with one of Ramsden's best sextants, and found the latitude of the S.W. end of it 51° 37′ N.; and, being off there for three successive days, still found it the same; every quadrant in the ship, at the time, agreeing within a mile or two of his observation.

Sailing still on, past the Skelligs and Blasquet, next day, he observed off the mouth of the Shannon, when Loop Head appeared to be in 52° 32′, Kerry Head 52° 30′, and Brandon Head 52° 22′. Captain Shortland remarks, that he was off there five days, and had excellent observations: and it was inferred that the part of the coasts of Ireland, between Dursey Island and Urris Head, had been laid down about 10 minutes to the southward of the truth; an error to which was ascribed the loss of the *York*, Indiaman, in Tralee Bay, on the 29th of October, 1758.

But it since appears, from the observations of Captain White, that those above described give latitudes rather *too far to the North;* Captain White placing Loop Head in 3 minutes less, and Dursey Island in 2 minutes less, than Captain Shortland.

VARIATIONS of the COMPASS.—In Dublin Bay, the late Admiral Bligh found the variation to be 26° 48′ in December, 1800. Captain Mudge, in 1830, gave it as 26° 30′. Off Dublin Bay it is now about 27° W. On the South of Ireland, near Cork, it was found, at the same period, to exceed 27¼ degrees: and, on the North of Ireland, about 29 degrees. In 1830, off the N.W. coast, it was found in lat. 55° 25′, lon. 10° 0′, to be 30½° W. In lat. 55° 17′, lon. 11° 0′, to be 31¼° W.; and, in lat. 54° 50′ N., lon. 10° 30′, it was 30¾° W.

THE PHAROLOGY OF IRELAND.

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
TUSKAR. One revolving light every 2 minutes; two sides bright, one *red*.	A white tower, 81 feet high, on the Tuskar Rock.	●	101	15	1815
CONINGBEG ROCK.	A lighthouse building.				
SALTEES LIGHT-VESSEL. Two bright fixed lights.	Off the Coningbeg Rock, in 20 fathoms; a flag; bell during fogs.	●	25	9	1824
HOOK TOWER. One bright fixed light.	A white tower, 110 feet high, on E. side of the entrance of Waterford.	●	159	16	1791
WATERFORD HARBOUR AND TIDE LIGHTS. 1. One bt. fixed light, and 2. Lower light between half-tides.	1. 2. On a tower on Duncannon Fort, E. side of the channel to Waterford.	●	53	[illegible]	1803
3. One bright fixed light.	3. A circular white tower, bearing N.N.E. ¾ E. 5½ cables from the preceding, and in one with it leads over the bar.	●	28	16	1838
DUNMORE HARBOUR. One fixed *red* light.	On the pier head; bright to northward.	●	44	11	1826
DUNGARVAN.	On Ballinacourty Point: building.				1851
MINSHEAD. One bright intermittent light every minute.	On the S. side of the head; visible 50 seconds, suddenly eclipsed 10 seconds.	●	285	21	1850
YOUGHAL.	On the W. side of the entrance: building.				1851
BALLYCOTTIN. One bright light flashing every 10 seconds.	A tower, 50 feet high, red under the gallery; on the outer island.	1 f	95	18	1850
CORK HARBOUR. 1. A *red* fixed lt. seaward; bt. within the harbour.	1. A white tower, 26 feet high, on Roche's Point, E. side of entrance.	●	92	14	1817
2. **LIGHT-VESSEL.** One bright fixed light.	2. In 3 fathoms; on the Spit Bank.	●	30		1840
3. **PILE LIGHTHOUSE.**	3. A screw pile lighthouse, on the N.E. point of the Spit Bank off Queenstown: building.				1851
KINSALE HARBOUR. One bright fixed light.	A building, 35 feet high, on Fort Charles, E. side of the harbour.	●	98	14	1804
KINSALE. One bright fixed light.	A white tower, 42 feet high, on the Old Head of Kinsale.	●	274	22	1805
CAPE CLEAR. One bright revolving light every 2 minutes.	A white tower, 42 feet high, on Cape Clear Island.	●	455	27	1817
FASTNET ROCK.	Lighthouse erecting.				
CROOKHAVEN. One bright fixed light.	On Rock Island Point, on the N. side of the entrance.	●	67	13	1843
ROANCARRIG ISLAND. One bright fixed light.	A white tower, with red belt, on the Island in Bearhaven.		55	12	1847
SKELLIGS. Two bright fixed lights.	Two towers, 26 feet high, 650 feet apart, N. by E. and S. by W. from each other, on the highest rock.	●	372 178	25 18	1826
VALENTIA. One bright fixed light.	On Cromwell's Fort.	●	54	12	1841
TRALEE.	On Little Samphire Island: building.				1851
SHANNON RIVER: BEEVES.	On the rock: building.				1851
TARBERT. One bright fixed light.	On the rock.	●	58	13	1834
KILCRADAN. *A fixed light, red to seaward, bt. to the harbour.*	A white tower, 26 feet high, on the point.	●	133	16	1824

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
LOOP HEAD. One bright fixed light.	A white tower, 49 feet high, on the head.	●	260	22	1802
MUTTON ISLAND. One bright fixed light.	A white tower, 26 feet high, off Galway Town.	●	33	10	1817
ARRAN. One brilliant revolving light every 3 minutes.	A white tower, 36 feet high, on the summit of Inishmore. The flash visible 15 seconds.	●	436	26	1817
SLYNE HEAD. One revolving light, bright, bt. and *red*, every 2 min. One bright fixed light.	Two white towers, 73 feet high, on outermost island, in one S. ¼ W. and N. ¼ E., 72 yards apart.	● ●	126 116	15 14	[illegible]
INISHGORT. One bright fixed light.	A white tower, 26 feet high.	●	96	10	1897
CLARE ISLAND. One bright fixed light.	A white tower, 26 feet high, on the N. point.	●	349	27	1806
EAGLE ISLAND. Two bright fixed lights.	On the rock, 3 miles W.S.W. from Urris Head. In one E. by N. and W. by S., 132 yards apart.	■	220	20	
BROADHAVEN. Building.	On Gubacashel Point, W. side of entrance.				1851
SLIGO BAY. 1. Two bright fixed lights. 2. One bright fixed light.	1. On Oyster Island, N.N.W. ¾ W. and S.S.E. ¾ E., 165 yards apart. 2. On Black Rock.	● ●	37 47 74	11 13	1837 1835
KILLYBEGS. 1. One bright fixed light. 2. One bright fixed light.	1. On the W. side of Rotten Island. 2. On St. John's Point.	● ●	67 104	19 14	1838 1831
RATHLIN O'BIRNE. Building.					1844
TORY ISLAND. One bright fixed light.	A stone tower, 63 feet high, on the N.W. point.	●	125	16	1892
LOUGH SWILLY. One *red* fixed light.	A white tower, 26 feet high, on Fannet Point. Light bright toward the Lough.	●	90	10	1816
INNISTRAHULL. One bright revolving light every 2 minutes.	A white tower, 26 feet high, on the N.E. part of the island.	●	167	18	1812
LOUGH FOYLE. Two bright fixed lights.	On Donagree Point, Inishowen, E. and W., 153 yards apart.	●	67	13	1837
RATHLIN ISLAND. Building.	On the N.E. point.				1851
MAIDENS. Two bright fixed lights.	Two white towers, with *red* belts, 60 feet high, N.W. by W. and S.E. by E., 640 yards apart.	● ●	94 84	14 13	1828
LOUGH LARNE. One bright fixed light.	On Farres Point.	●	[illegible]	11	1839
BELFAST BAY. One bright fixed light.	A screw pile lighthouse on Hollywood Bank.				1848
COPELAND. One bright fixed light.	A white tower, 52 feet high, on Small Copeland Island.	●	131	16	1796
DONAGHADEE HARBOUR. One *red* (or bright) fixed lt.	On the S.E. pier head. Bright towards the harbour.	●	56	12	1836
SOUTH ROCK. One bright revolving light every 1½ minutes.	A white tower, 60 feet high, on the rock.	●	52	12	1797
ARDGLASS. One *red* light (temporary).			18	11	1816
DUNDRUM BAY. One bright revolving light every minute.	A white tower, with red belt, on St. John's Point.	2d	62		1844
CARLINGFORD. 1. One bright fixed light. *Lower fixed Tide Light.*	1. In one tower, 111 feet high, on Haulbowline Rock. The lower light from half flood to half ebb. A bell in fogs.	●	101	15	1823

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
CARLINGFORD. 2. One revolving light every 45 seconds.	2. A white tower, 96 feet high, on Greenore Point.	●	29	9	1830
DUNDALK. Building.	On S. side of entrance channel.				1851
DROGHEDA. Three bright fixed lights.	On timber framings on the sand hills, S. side of the River Boyne. Moved as the banks shift. The E. and W. lights in one lead over the bar.		30 40 28		1842
BALBRIGGAN. One bright fixed light.	On the pier.		35	10	1769
HOWTH HARBOUR. One *red* fixed light.	On the E. pier head. Also two small lights on W. pier head, as a leading mark.		43	11	[illegible]
BAILEY. One bright fixed light.	A white tower on the S.E. point of Howth peninsula.	■	134	15	1813
POOLBEG. 1. One bright fixed light. *Lower fixed Tide Light.* 2. One fixed light.	1. In the same white tower, 63 feet high, on the end of S. wall; entrance to Dublin. The lower light (fainter) from half flood to half ebb. 2. On the end of the S. wall.	■ ●	68 33	12 10	1768 1820
KINGSTOWN. 1. One revolving light, bright and *red* alternately, every half min. 2. One small *red* light.	1. On the E. pier of the harbour. 2. On the W. pier.	●	34	9	1823
KISH LIGHT-VESSEL. Three bright fixed lights, triangular.	In 8 fathoms, off the N. point of the Kish Bank. A flag; bell in fogs.	●	25	9	1811
WICKLOW. Two bright fixed lights.	Two white towers, 58 and 29 feet high, on Wicklow Head, N.W. by W. ¾ W. and S.E. by E. ¾ E., 160 yards asunder.		250 121	21 16	1818
ARKLOW LIGHT-VESSEL. One bright fixed light.	In 13 fathoms, at the S. end of the bank. A flag; a bell in fogs.	●	25	9	1824

4. FRANCE, ETC.

POSITIONS OF PLACES.

	LATITUDE. ° ′ ″	LONGITUDE. ° ′ ″	AUTHORITIES.
NORTHERN COAST.			
PARIS; *Royal Observatory*[1]	48 50 14	2 20 22 E.	Originally from the triangles
Antwerp, or Anvers	51 13 16	4 24 19 —	intended merely for the ad-
Ostende	51 13 57	2 55 17 —	measurement of the degrees of
Nieuport	51 7 54	2 45 24 —	the meridian in France, but
DUNKIRK; (Dunkerque)			ultimately carried on through-
Lighthouse, Pier head	51 3 0	2 22 3 —	out the kingdom. These were
Calais; Light-tower	50 57 36	1 51 8 —	commenced by M. Picard, who
Cape Grisnez Light	50 52 10	1 35 9 —	effected an admeasurement
Boulogne; Light, W. Jetty			between Paris and Amiens in
head	50 43 56	1 35 18 —	1669, and finally completed by
Point d'Alpreck; Light	50 41 57	1 33 53 —	Messrs. Mechain and Delambre,
Etaples; Lornel Light	50 33 38	1 34 39 —	in 1798; after having exercised
——— Touquet Lights	50 31 43	1 35 44 —	the abilities and industry of M.
Cayeux; Lighthouse	50 11 42	1 30 54 —	Cassini the elder, his son, and

FRANCE—continued.

	Latitude.	Longitude.	Authorities.
	° ′ ″	° ′ ″	
Tréport; Tide Light	50 3 53	1 22 21 E.	grandson; and of MM Miraldi and De la Caille, with other of the most eminent French astronomers, &c., to the present time.
Dieppe; Tide Light	49 56 2	1 5 10 —	
L'Ailly; Lighthouse	49 55 7	0 57 42 —	
St. Valery en Caux; Tide Light	49 52 25	0 42 42 —	
Fecamp	49 46 5	0 22 19 —	
La Hève; High Light	49 30 43	0 4 15 —	
Havre; Harbour Light	49 29 0	0 6 17 —	
Quillebœuf, Harbour Light	49 28 26	0 31 38 —	
Honfleur; Upper Light	49 25 32	0 13 50 —	
Mouth of the Orne; Upper Light	49 16 37	0 15 2 W.	
Barfleur; North Jetty Head Light	49 40 14	1 15 26 —	
Cape Barfleur, or Point Gatteville; Lighthouse	49 41 52	2 15 48 —	
Cherbourg; Pelée Light	49 40 16	1 34 53 —	
Granville; Lighthouse	48 50 7	1 36 39 —	
Cape Frehel; Lighthouse	48 41 5	2 19 2 —	
Le Rohinet; Islet	48 40 33	2 28 40 —	
Cape d'Erqui	48 38 45	2 29 11 —	The excellent Surveys of the Coast by the French Engineers, under the direction of M. Beautemps Beaupré, 1830 31, and according to which, the Charts have since been corrected.
Les Countesses; Western Rock	48 38 58	2 34 23 —	
Grand Lejon (Rock)	48 45 0	2 39 45 —	
Harbour Isle off St Quay	48 40 2	2 48 22 —	
Isle Bréhat; N.E. Point	48 51 54	2 59 8 —	
Héaux de Bréhat, Lighthouse	48 54 33	3 5 4 —	
Les Sept Iles; Lighthouse	48 52 46	3 29 40 —	
Ile de Bas; Lighthouse near the West end	48 44 45	4 1 29 —	
Ouessant or Ushant; Lighthouse	48 28 30	5 3 18 —	
The Bay of Biscay.			
Lampaul	48 33 40	4 38 18 —	The Hydrographic Surveys of the Western Coasts of France, made under the direction of M. Beautemps Beaupré; an Exposition of which, by M Daussy, was published at Paris, by authority, in the years 1829 and 1839.
St. Mathieu; Lighthouse	48 19 49	4 46 10 —	
Brest; St. Louis	48 23 20	4 28 27 —	
Bec du Raz, Lighthouse	48 2 22	4 43 50 —	
Ile de Sein; Lighthouse	48 2 35	4 51 53 —	
Penmarc'h; Lighthouse	47 47 53	4 22 23 —	
Penfret; Lighthouse	47 43 17	3 57 8 —	
Ile de Groix; Western Lighthouse	47 38 56	3 30 28 —	
Port Louis; St. Pierre	47 42 31	3 20 21 —	
Belle Isle; Lighthouse on S W Point	47 18 43	3 13 30 —	
Isle Hœdic; Lighthouse	47 20 32	2 51 58 —	
Le Four; Lighthouse	47 17 53	2 37 56 —	
Aiguillon; Lighthouse	47 14 33	2 15 39 —	
Piliers; Lighthouse	47 2 36	2 21 42 —	
Ile d'Yeu; Lighthouse	46 43 5	2 22 47 —	
St. Gilles sur Vie	46 41 46	1 55 1 —	
La Chaume; Lighthouse	46 29 42	1 47 37 —	
Sables d'Olonne; Lighthouse	46 29 28	1 47 22 —	
Ile de Ré; Baleine Lighthouse	46 14 44	1 33 35 —	
——— Port of St Martin	46 12 26	1 21 44 —	
Rochelle; Harbour Light	46 9 21	1 9 17 —	
Oleron; Chassiron Lighthouse	46 2 52	1 24 30 —	

Remarks.

It is to be remarked, that the longitudes, as given in the *Connaissance des Temps*, compared with those in the Charts of the *Pilote Français*, constructed between 1816 and 1827, under the direction of *M. Beautemps Beaupré*, show a difference amounting

FRANCE—CONTINUED.

	LATITUDE.	LONGITUDE.	AUTHORITIES.
	° ′ ″	° ′ ″	
Isle of Aix; Harbour Light	46 0 36	1 10 33 W.	to, at the least, 51″, the former Survey being so much less; which is occasioned by the later determination of the geographical position of Brest. The corrected longitudes are given in the Table. The HYDROGRAPHIC SURVEYS.
Point de la Coubre; Light.	45 41 30	1 15 12 —	
Port of Royan; Light	45 37 8	1 1 41 —	
Cordouan Lighthouse	45 35 14	1 10 17 —	
Pauillac; Harbour Light ..	45 11 55	0 44 33 —	
BORDEAUX; West Point of St. André	44 50 16	0 33 42 —	
Point de Grave; Lighthouse	45 34 29	1 3 26 —	
Beacons East of Capbreton	43 39 26	1 25 31 —	
La Teste de Buch	44 37 57	1 8 0 —	
Signal Tower of the River Adour	43 31 36	1 29 53 —	
Bayonne	43 29 26	1 27 44 —	
Biarritz; Lighthouse	43 29 38	1 33 36 —	
Socoa; Harbour Light	43 23 44	1 41 6 —	

NOTES.

1. PARIS.—The grand operations, in point of accuracy, for the determination of the length of the degrees of the meridian, have taken place since 1783. In that year a memorial was transmitted by M. Cassini de Thury to the Right Hon. Charles James Fox, then Secretary of State, showing the advantages that astronomy would derive from the construction of a series of triangles, that should connect, trigonometrically, the Observatories of Greenwich and Paris, and thus correctly determine their relative positions.

This application caused the operations by General Roy, already explained, which have since extended into a General Survey. This gentleman, in England, acted in conjunction with Messrs. Cassini, Mechain, and Legendre, in France; but it unfortunately happened that the results of the two parties did not exactly agree; that of the British officers being, for the difference of longitude, 2° 19′ 51″, while that of the French was 2° 20′ 15″.

In order to determine this question, the subject was resumed in 1821, on the suggestion of the French authorities. The operations have consequently been repeated, under the direction of commissioners, nominated, respectively, by the Academy of Sciences and the Royal Society. An account of the operations and results have been given in the "Transactions" of the latter, and the final determination is, that 2° 20′ 22″ is the difference between the meridians of Paris and Greenwich. This, of course, is now adopted, as shown in the Table.

VARIATIONS OF THE COMPASS.—The Variation at the Isle of Bréhat, in 1831, was found to be 24° 49′ W.; at Ushant it is about 26°. The variations as given by the surveyors under M. Beaupré, in 1829, were as follow:—

At Crozon, in latitude 48° 14′ 48″, 25° 7′ W.: L'Orient, 24° 28′: Noirmoutier, 24°: Ile d'Yeu and Sables d'Olonne, 23° 42′: Anchorage of Aiguillon, 23° 6′: Baleine Lighthouse, 23° 10′: Rochelle, 23° 6′: Ile d'Aix and Rochefort, 22° 59′: Cordouan Lighthouse, 22° 30′: Bassin d'Arcachon, 22° 23′: St. Jean de Luz, River Adour, &c., 22° 19′.

In 46° 24′ and 10° 15′ the *Baron Roussin* found it 25° W. in 1823. For some remarks on Basque Roads, &c., by Captain Smyth, see Section III. hereafter.

THE PHAROLOGY OF FRANCE.

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
DUNKIRK. One bright revolving light visible every minute.	A tower, 180 feet high, between the sluice gates and the old Fort Risban, at half a mile, S.E. by E. ½ E., from the end of the W. jetty.	1d	193	24	
DUNKIRK HARBOUR. Two bright fixed lights.	1. On the N. end of the W. jetty.	●	23	6	
	2. On the Heuguenar tower, at 2,400 yards, S.E. by E. ½ E., *true*, from the entrance, and only visible in the direction of the entrance.	■	85	15	
GRAVELINES. One bright fixed light.	A red column on Fort Philippe, E. side of the entrance.	3b	102	15	1843
GRAVELINES HARBOUR. 1. A small fixed light. 2. A small fixed *tide light*, while 6 feet water.	Two fishing lights, on posts, only shown while the boats are in sight; kept in one they lead in.			2	
CALAIS. A fixed light, varied by a bright flash every 4 min.	On a new tower, 167 feet high, and 1,312 feet E. from the old tower.	1f	190	21	1848
CALAIS HARBOUR. A *red* fixed light.	On the N. extremity of the W. jetty.		16	2	1842
Calais Tide Light. A bright light, with 8½ feet water.	On Fort Rouge, to the right of the entrance.	4a	33	10	
CAPE GRISNEZ. A bright revolving light visible every ½ minute.	A tower, 46 feet high, on the summit of the cape.	1d	193	22	
Boulogne Tide Lights. One *red*, two bright fixed lights.	A *red* light, with 9½ feet water, on the N.E. jetty head.		16	1	
	Two bright lights perpendicularly, on the S.W. jetty head; the upper with 9½ feet, and the lower at high water. A flag by day shows the same.	4a	43 33	9	1835
PTE. D'ALPRECK. A bright light, varied by a *red* flash every 2 min.	On a building, 33 feet high, near the old Semaphore tower, 2½ miles S.W. from Boulogne entrance.	4f	161	10	1842
BAY OF ETAPLES. 1. One bright fixed light.	1. Lornel light, on the N. side of the Mouth of the Canche.	●	52	6	
2. Two bright fixed lights.	2. Touquet, two lights on the S. side of the Mouth of the Canche, 53 feet apart.	●	52	6	
MOUTH OF THE CANCHE. Two brilliant fixed lights (constructing).	Two fine lighthouses, 1,312 feet S. of the Touquet lights, and 820 feet apart, N. and S.				
PTE. DE BERCK. One bright fixed light.	A building, 36 feet high, on the point of the Haut-banc of Berck.	4a	65	9	1836
River Somme small Tide Light.	On the S side of the mouth of the Somme, on Pte. Hourdel.			2	
CAYEUX. Fixed light, varied by a flash every 4 minutes.	A round red brick tower, like a Doric column, on the S. side of the Bay of the Somme.	3f	92	15	1835
Tréport Tide Light. A bright fixed light, while 6½ feet.	Near the N. end of the western jetty. A flag by day for 8½ feet water.	4a	36	9	
DIEPPE HARBOUR and *Tide Lights.* Four bright fixed lights.	1. Three lanterns on a mast, on the E. jetty head. The upper all night, the two lower according to the depth.		23	4	
	2. A fixed light on the W. jetty, while 11 feet water. A flag by day at 10½ feet water.	4a	30	10	

Name and Description of Light.	Situation, &c.	Description of Apparatus	Height above High Water	Visible in Miles	Year erected.
AILLY. A bt revolving lt. in 30 sec.	A tower, 65 feet high, on the cape.	●	305	18	
St. Valery-en-Caux Tide Lt. Bt. and fixed, while 6¼ ft.	A small brick tower, on the western jetty. A flag by day for the same period of tide	●	30	6	
FÉCAMP. One bright fixed light.	A tower, 56 feet high, on Pointe Fagnet.	1b	426	18	
Fécamp Tide Light. Fixed lt., varied by a flash every 3 min., while 11 ft.	On the northern jetty. A flag by day denotes the same.	4f	39	9	1836
CAPE LA HÈVE. Two bright fixed lights.	Two freestone towers, N.E. and S.W., 207 feet apart, and 70 feet high, near the edge of the cliff.	1b	397	20	
HAVRE HARBOUR. 1. One bright fixed light	1. On the N. jetty.	4a	39	10	
2. A small *orange* coloured light.	2. On the S.E. jetty head.			1	
POINTE DU HOC. A bright fixed light.	At 3½ miles above the entrance to Havre.	4a	39	10	1843
LOWER SEINE. Fourteen fixed lights.	Above the Havre the lower Seine is lighted by fourteen fixed lights, including that on the Pointe du Hoc, but are useless without the aid of the river pilots.				
HONFLEUR HARBOUR LTS. 1. One bright fixed light.	1 On the hospital jetty, at the N.W. extremity of the town.	●	33	8	
2. A fixed *red* light.	2 On the head of the new eastern jetty.	4a	20	6	1843
RIVER TOUQUET. One fixed *tide light*, while 7¼ feet.	On the W. side of the entrance, 450 feet apart, kept in one, lead through the Channel to Trouville.	●	20	6	
One fixed bright light.		●	33	6	
RIVER ORNE. 1, 2. Two bright fixed lights.	1. Outer light, on the downs near the Ovestreham redoubt.—2. Inner light, from the steeple of Ovestreham church. These two lights are 1,312 yards apart, N.E. and S.W., and in one show the direction of the entrance.	● 4a	39 92	4 10	
3. *A small red tide light*, between 3 hours before and after high water.	3. On the N. end of the W. jetty, on the outer port.			2	
COURSEULLES HARBOUR. One bright fixed light.	On the head of the western jetty.	●	30	4	
POINTE DE VER. A fixed light, varied by a flash every 4 minutes.	A tower 42 feet high.	3f	138	15	1837
PORT EN BESSIN. A small fixed light.	Between September and April, in bad weather.		33	2	1836
GRANDCAMP. A small fixed light.	At 1¼ miles W. of the village church.		26	2	1836
ST. MARCOUF ISLE. One bright fixed light.	On the fort of the island.	4a	56	9	1840
LA HOUGUE. Three bright fixed lights.	1. On the S. end of the fort of La Hougue.	4a	36	9	1836
	2. On the hillock of Morsaline.	4a	282	10	1836
	3 On the Réville redoubt (Pointe de Saire).	4a	36	9	1836
POINTE DE BARFLEUR. One revolving light every half minute.	On the summit of the Pointe de Barfleur or Gatteville.	1b	236	22	
BARFLEUR HARBOUR. Two bright fixed lights.	1. On the left-hand side of the entrance to the port.	4a	23	9	
	2. At 928 feet, S.W. by W. ¼ W., of the previous light.	4a	43	9	
	In one they show the direction of the entrance.				

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water	Visible in Miles	Year erected.
CHERBOURG. 1 A bright fixed light.	1 At the E. entrance to Cherbourg Road, on Fort Royal, on Pelée Island.	4a	85	10	1839
2 A bright fixed light, varied by a flash every 3 minutes.	2. On the central fort of the breakwater, at 2.843 yards, S.E. by E $\frac{1}{2}$ E. from that on Pelée Island	4f	66	9	
3. A bright fixed light.	3 At the W entrance to the roads, on a tower built on Fort Querqueville.	4a	59	10	1838
4. A fixed *red* light.	4. On the head of the eastern jetty of the Port du Commerce.	4a	33	3	
CAPE DE LA HAGUE. A brilliant fixed light.	On the rock called the Gros du Raz, half a mile, W. $\frac{3}{4}$ S. of the point of Cape de la Hague.	1b	167	18	[illegible]
CAPE CARTERET. A bright revolving light, visible every half min.	A tower, 49 feet high, on the cape.	2d	262	18	
CASKETS Three bright revolving lights, all visible simultaneously, every quarter of a minute.	Three white towers, placed triangularly, one 13 feet, and the others 38 feet high, bearing E $\frac{1}{4}$ N. 185 feet, S W. $\frac{3}{4}$ W. 138 feet and N W. $\frac{1}{4}$ W from each other, on the highest of the Casket Rocks. A bell in fogs. (English since 1783)	●	81 each	15	1723
GUERNSEY. One bright fixed light.	On a tower, 30 ft high, on the pier head of St. Pierre. S. side of the entrance (English.)	●	40	11	1832
CHAUSEY. A bright light, varied by a *red* flash every 4 min.	On the Grand Ile de Chausey.	1f		15	1847
GRANVILLE. A bright fixed light.	A tower, 42 feet high, on the rock of Granville, or Cape Lihou.	3a	154	15	1839
GRANVILLE HARBOUR. A fixed *red* light.	On the S E end of the new mole, on the left of the entrance.	4a	26	3	1842
ST MALO. A bright fixed light.	On the head of the new Môle des Noires to the left of the entrance.	4a	33	[illegible]	
CAPE FRÉHEL. A bright revolving light, visible every half min.	A tower, 72 feet high, and 115 feet, S. 60° E , from the old tower on Cape Fréhel.	1d	259	22	
HÉAUX DE BRÉHAT. A brilliant fixed light.	On the rocks of the Héaux de Bréhat.	1b	147	18	1836
SEPT ILES. A fixed light, varied by a flash every 3 minutes.	On a tower. 36 feet high, on the eastern extremity of the Ile aux Moines.	4f	167	10	
RADE DE MORLAIX. 1. A fixed light, varied by a flash every 2 minutes.	The direction of the Tréguier Channel is shown by the two lights following :—	4f	46	10	
2. A bright fixed light. 3. A small *red* fixed light.	1. On the Ile Noire.—2 On the Tour de la Laude, 56 feet high. Also, 3. On the S. face of the Château du Taureau (820 yards, N. 60° W., from the Ile Noire)	●	285	12	
ILE DE BAS. A bright revolving light, visible every minute.	A tower, 131 feet high, on a hillock on the W. part of the Ile de Bas.	1d	225	24	1836
ILE VIÈRGE. A bright fixed light, varied by a *red* flash every 4 min.	At 107 yards W. of the eastern point of the Ile Vièrge, 2 miles N E. of the outer anchorage of Abrevrac'h.	3f	108	15	1845
ABREVRAC'H. 1. A fixed *red* light.	1. The wes ern light, from a white tower, 36 feet high, on the Ile Vrac'h, on the N. side of the entrance.	4a	59	4	1845
2. A bright fixed light.	2. The eastern light, on the W. gallery of the steeple of Plougnerneau, $3\frac{3}{4}$ miles, S. 79° 22′ E , from that on Ile Vrac'h. In one they show the direction of the outer part of the channel.	4a	220	10	1845

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Heights above High Water.	Visible in Miles.	Year erected.
Abervrac'h Inner Road. 1. A fixed *green* light.	1. Outer light, at the extremity of the Grève de la Palue.	●	29	3	
2. A fixed bright light.	2. Inner light, at the bottom of the cove Saint Antoine. These two in one lead in beyond the preceding lights.	●	49	4	
USHANT. A brilliant fixed light.	A tower, 65 feet high, on the N.E. point of the island.	1b	272	18	
Kermorvan. A bright fixed light.	On the Pte. de Kermorvan, to the W of the Port of Conquet. When in one with that of St. Mathieu, it shows the direction of the Chenal du Four.		72	12	1849
ST. MATHIEU. A bright revolving light, visible every half min.	A tower, 82 feet high, on the Pointe de St. Mathieu, at 7 miles W. of the entrance to Brest.	2d	177	18	1835
Brest. 1. Petit Minou, fixed light.	1. On the point on the N.W. of the entrance to the Goulet of Brest.	●	105	15	
2. Portzic, fixed light, varied by a flash every 3 minutes.	2. On the point, 4 miles E. ½ S. of the former; in one they show the direction of the Channel.	4f	184	14	
3. Toulinguet, one bright fixed light.	3. On the S.W. point of the entrance, near Camaret.	2a	161	9	1849
ILE DE SEIN. A fixed light, varied by a bright flash every 4 min.	On the N. point of the island.	1f	148	20	[illegible]
BEC DU RAZ. One bright fixed light.	A tower 49 feet high.	1a	259	18	1843
PENMARC'H. One bright revolving light every half minute.	On the point near St. Pierre church.	1d	135	22	
Odet River. 1. One *red* fixed light. 2. One bright fixed light.	1. On the Pte. du Coq, on the left bank. 2. N. by W. ¼ W., 291 yards from the other. In one they lead in.	● 4a	33 56	9 9	1848
Penfret. A bright light, varied by a flash every 4 minutes.	A tower, 72 feet high, on the N. point of one of the Glenan Islands.	3f	118	15	
Concarneau Two bright fixed lights.	On the Battery de la Croix, and between Concarneau and Beuzec, 2,052 yards N.N.E. ½ E. from the former.	●	46 177	9 12	1840
ILE DE GROIX. 1. One bright fixed light.	1. A tower, 75 feet high, on the N.W. point of the island.	1a	194	18	
2. A bright light, varied by a red flash every 3 min.	2. On the Fort de la Croix.	4f	171	10	
L'Orient. Two bright fixed lights.	One on the little hill of La Perière; one on the church.		75 148	9 9	1850
BELLE ISLE. One bright revolving light every minute.	A tower, 151 feet high, in Goulfar Bay.	1b	270	27	
Port de Palais. One bright fixed light.	On the Mole head, S. side of entrance.	4a	50	9	1836
Hœdic Island. One bright fixed light.	A tower, 40 feet high, 600 yards from the E. point.	4a	85	9	1836
La Teignouse. A bright light, varied by a bright flash every 3 min.	On the rock to the S. of the Quiberon Peninsula.	4f	50	10	
Port Haliguen. One fixed light.	On the head of the E. jetty.	●		6	1842
Port Navalo. One bright fixed light.	A tower, 33 feet high, to the right of the entrance to Morbiham.	4a	72	9	1840
Pointe de Penlan. One bright fixed light.	On the point on the N. side of the mouth of the Vilaine.	4a	52	9	

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
LE FOUR. One bright revolving light every half minute.	On the Rocher du Four.	2 c	79	18	1822
PORT DU CROISIC. Two fixed lights.	On the shore, N.N.W. and S.S.E., 50 yards apart.	●	13 33	6 6	1838
RIVER LOIRE. 1. AIGUILLON TOWER. One bright fixed light.	1. Tower, 59 feet high, on the N. side.	3 a	112	12	
2. COMMERCE TOWER. One bright light, varied by a bt. flash every 2 min.	2. Tower, 46 feet high, S. 55° W., 2,144 yards from the former.	3 f	128	14	
PORT DE ST. NAZAIRE. One bright fixed light.	On the head of the new mole.	4 a	26	8	1836
PORT DE PORNIC. One bright fixed light.	A tower, 33 feet high, on Pte. de la Noveillard.	4 a	56	10	1846
LE PILIER. A bright light, varied by a bright flash every 4 min.	On the N.W. point of the island.	2 f	105	18	
ILE D'YEU. One bright fixed light.	A tower, 108 ft. high, on Petite Foule Hill, 1,800 yds. from the N. point of the island.	1 a	177	18	
PORT BRETON. Two bright fixed lights.	One on the outer jetty head, N. of the entrance; one at the head of the harbour. In one they lead in.	4 a	23 49	9 9	
LA CHAUME. One bright fixed light (temporary).	At 85 feet above the quay, W. of the entrance of Sables d'Olonne Port.	4 a	118	10	
SABLES D'OLONNE. One bright fixed light.	On the head of the jetty, E. side of the entrance.	4 a	23	9	
PERTUIS BRETON. Two bright fixed lights.	1. On the Pte. du Grouin du Cou.—2. On Pte. de l'Aiguillon.	4 a	59 33	9 9	
BALEINES. A bright revolving light every ½ minute.	On the N.W. point of the Ile de Ré. The flashes are unequal. Each brighter flash is followed by one a third fainter.	●	85	16	
PORT DE ST. MARTIN. One *red* fixed light.	On the angle of the demi-bastion, 109 yards E. of the entrance.	4 a	52	6	
PORT DE LA FLOTTE. One bright fixed light.	On the new mole.	[illegible]	30	9	1849
CHAUVEAU POINT. One bright fixed light.	On the rocks of the E. point of the Ile de Ré.	[illegible]	72	14	1842
LA ROCHELLE. One bright fixed light.	At 40 feet E. from the Tour de la Lanterne, W. side of entrance.	●	46	10	
CHASSIRON. One bright fixed light.	A tower, 141 feet high, on the N.W. point.	1 b	164	18	
ILE D'AIX. One bright fixed light.	On the fort at the S. point.	4 a	56	10	
PTE. DE LA COUBRE. One bright fixed light.	On the N. point of the mouth of the Gironde.	4 a	66	10	
TERRE NEGRE. One bright fixed light.	On the N. side of the mouth.	4 a	116	10	
ROYAN. One bright fixed light.	On the heel of the jetty.	●	36	6	
CORDOUAN. A brilliant revolving light every minute.	A noble tower, 207 feet high, at the mouth of the Gironde. Each bright flash is immediately preceded by a fainter one.	1 c	207	24	1727
POINTE DE GRAVE. A bright fixed light (temporary).	A wooden scaffold on the point.	[illegible]	39	9	1828
TALLAIS BANK LIGHT-VES. One bright fixed light.	In 4 fathoms; has a black ball; a bell during fogs.	●	33	9	1845
RICHARD. A *red* fixed light.	On the S. side of the Gironde, 19 miles above Pte. de Grave.	[illegible]	56	8	1846

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
PAUILLAC. A small fixed light.	On the landing place, W. side of river.		20	4	
BLAYE. A small fixed light.	On the landing place, E. side of river.		16	4	
ARCACHON BASIN. One bright fixed light.	On Cape Ferret.	1m	167	18	1840
BIARRITZ. One bright revolving light every half minute.	A tower, 144 feet high, on Pte. St. Martin de Biarritz.	1d	240	20	
PORT DU SOCOA. One bright fixed light.	A tower, 33 feet high, on the W. side of the entrance to the bay of St. Jean de Luz.	4m	115	10	

5. SPAIN AND PORTUGAL.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″
MADRID; Grand Place [1]	40 24 57	3 41 38
Fontarabia	43 21 46	1 46 32
Cape Higuera: Light	43 23 25	1 46 42
St Sebastian; Lighthouse	43 19 18	1 58 39
Cape Machichaco	43 28 0	2 39 48
Portugalete	43 20 10	2 58 20
Santander; Lighthouse on Cape Mayor	43 30 10	3 39 52
Cape Peñas; Islet	43 42 16	5 46 40
Ribadeo; Entrance of the Harbour	43 34 45	6 59 40
Vivero; Entrance of the Harbour	43 43 45	7 32 45
Point de la Estaca	43 47 50	7 38 50
Cape Ortegal; Lighthouse	43 46 40	7 50 30
Cape Prior	43 34 15	8 12 45
Ferrol; Entrance of the Harbour	43 28 0	8 15 15
Corunna; Lighthouse	43 23 36	8 19 35
Cisargas Isles, off Cape St. Adrian	43 22 15	8 47 30
Cape Villano	43 11 20	9 10 20
Cape Toriana	43 3 0	9 17 0
CAPE FINISTERRE	42 54 0	9 16 15
Vigo	42 13 20	8 39 45
Caminha, at the Entrance of the Minho	41 52 42	8 44 30
Villa do Conde [2]	41 21 20	8 36 42
Porto or Oporto, the Bar of*	41 10 15	8 38 0
Aveiro, the Bar of	40 38 30	8 41 0
Cape Mondego*	40 12 30	8 53 48
Nazareth; the Church	39 36 36	9 4 45
Berlengas or Berlings (*Mid of the greatest*); Lighthouse	39 24 40	9 31 11
Peniche, or Cape Carvoeiro; Lighthouse	39 21 20	9 24 16

AUTHORITIES.

These positions of Places in Spain and Portugal are given on the authority of Don VINCENTE TOFIÑO, and Don JOSEF VARELA, of the Spanish Marine, and of Major FRANZINI, of the Portuguese Royal Engineers; whose valuable Charts and observations have been made use of in the delineation of the coasts. It is, nevertheless, to be noticed, that we have, both in this Table and in the Chart, adopted some subsequent emendations received through the medium of the *Connaissance des Tems*, &c.

Captain *Edw. Belcher*, in 1833, on his Survey of the Douro, made the Fort of St. João da Foz, on the North side of the entrance, 41° 8′ 48″ N., and 8° 37′ W.

REMARKS.

Since the publication of our first edition, we have been favoured by Captain William Henry Smyth, of the Royal Navy, with a series of determined points, previously given by Tofiño, &c., as shown in the Table. They were settled by this gentleman, when a lieutenant, in 1811 and 1812, by lunar and chronometric observations. We prefer giving both, because it affords a mean of estimating the respective value of each. The points given

SPAIN AND PORTUGAL—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Cape Roca, or Rock of Lisbon;* Lighthouse	38 46 30	9 29 56	by Captain Smyth, distinguished by asterisks in the Table, are as follow:— Oporto, 41° 10′ 30″ N., 8° 37′ 18″ W.: Cape Mondego, 40° 13′ 30″ N., 8° 52′ 45″ W.: Cape Roca, 38° 46′ 15″ N., 9° 25′ 10″ W.: Lisbon, 38° 42′ 35″ N., 9° 5′ 50″ W.: Cape Espichel, 38° 25′ 30″ N., 9° 10′ 0″ W.: Cape St. Vincent, 37° 2′ 10″ N., 9° 1′ 10″ W.: Lagos, 37° 8′ 40″ N., 8° 37′ 45″ W.: Cape St. Mary, 36° 57′ 0″ N., 7° 54′ 30″ W.: Chipiona, 36° 43′ 50″ N., 6° 24′ 30″ W.: Cadiz, 36° 32′ 28″ N., 6° 17′ 30″ W.: St. Sebastian Light, 36° 31′ 10″ N., 6° 18′ 50″ W.: Tarifa, 36° 0′ 50″ N., 5° 36′ 15″ W.: Gibraltar, 36° 6′ 30″ N., 5° 21′ 12″ W.
LISBON; OBSERV. ... [3]	38 42 40	9 8 30	
Cape Espichel, or Spichel; Lighthouse	38 24 54	9 13 0	
Bar of Odemira	37 39 0	8 50 0	
Cape St. Vincent*	37 2 54	9 0 54	
Lagos*	37 8 0	8 37 45	
Cape Santa Maria, or St. Mary*	36 55 36	7 49 12	
Monte Figo (*height* 2,000 ft.)	37 9 42	7 42 30	
Point Chipiona,* Entrance to St. Lucar	36 44 18	6 24 15	
CADIZ; OBSERV.* .. [4]	36 32 0	6 17 30	
St. Sebastian Lighthouse ..	36 31 10	6 18 42	
Cape Trafalgar	36 10 15	6 1 30	
Isle of Tarifa;* Lighthouse	36 0 50	5 36 10	
GIBRALTAR; Europa Point,* Lighthouse .... [5]	36 6 20	5 19 46	

NOTES.

1. GENERAL NOTE.—The Charts of the Coasts of Spain and Portugal have heretofore been regulated chiefly by the observations made by *M. Bory*, some of whose results approached very nearly to those which we have given; as of Cape Finisterre, 42° 51′ 52″, longitude 9° 18′ 25″; but others deviate considerably. The whole, as now given, have, however, been modified by the latest and most authentic observations, and there is reason for believing that no error, of material consequence, will hereafter be found.

For a more particular detail, see the New Chart of Spain and Portugal, with the harbours, &c., on an enlarged scale, constructed by the Editor, and published by the Proprietor of this work.

2. VILLA DO CONDE, September, 1833.—H.M.S. *Orestes* had struck on a sunken rock, previously unknown, off the town of *Villa do Conde:* the bearings from the rock were, the North part of the town, E. ½ N.; the South part, E. ½ S.; distance upwards of 3 miles.

3. LISBON.—The longitude of Lisbon had been previously assumed as 9° 8′ 40″, being a mean result of observations made by the astronomers *De la Caille*, *Pingré*, and *Messier*, according to a great number of eclipses of the first satellite of Jupiter. The occultation of a star by the moon, October 5, 1753, with a corresponding one at Paris, gave one minute more. Captain *Fitzwilliam Owen*, in the Memoir of his important expeditions to Portugal and Africa, assigns to the Arsenal of Lisbon 38° 42′ 18″ N., and 9° 8′ 54″ W., from observations made in H.M.S. *Leven*, in 1819 and 1822.

4. CADIZ.—The position of the Observatory in the city of Cadiz is established as 36° 32′ 0″ N., and 6° 17′ 30″ W. The New Observatory (*Real Observatorio*) of San Fernando, in the Isle of Leon, is in 36° 37′ 43″ N., and 6° 12′ 16″ W.

The port of Cadiz was established as a free port, for the vessels of all nations, in the early part of the year 1829; and, in consequence, many English houses from Gibraltar soon removed hither, or established a branch house here; so that our trade with Cadiz soon became more extensive than with Gibraltar.—(*Sept.* 1830.)

5. GIBRALTAR, &c.—Mr. Charles Rumker gives the position of Europa Point, Gibraltar, as 36° 5′ 15″ N., and 5° 20′ 15″ W.; of Alboran Isle, as 35° 56′ N., and 3° 3′ W.; and of Cabrera, as 39° 7′ N., and 2° 59′ 15″ W.—*Edinburgh Phil. Journal*, vol. i. p. 322. The late Captain Bauza, of the Hydrographic establishment at Madrid,

gave Tarifa in 36° 0′. This accords with Mr. Rumker; but Captain Livingston made the latitude of Europa Point, by sextant and artificial horizon, in 1820, 36° 6′ 10″, and exactly the same on another day, by the sea horizon. Captain Smyth has given Gibraltar in 36° 6′ 30″, and 5° 21′ 12″.

It is to be observed, that Lieutenant Raper adopts 5° 21′ 17″, as the longitude of the Mole (or Europa Point in 5° 22′ 0″), and this is from the observations of Captain Smyth; Captain Shirreff 5° 20′ 36″; and Captain Vidal 5° 21′ 42″. This position is important, as it affects the longitudes of the West coast of Africa.

For the positions of places within the Strait, see our "*New Directory for the Mediterranean Sea.*"

VARIATIONS OF THE COMPASS.—Captain Smyth found the variation off Portugal, in latitude 38° 2′, longitude 14° 34′, to be 23° W. in 1804; and, in 1833, Captain Edward Belcher, at the mouth of the Douro, found it to be 23° 45′ W.

THE PHAROLOGY OF SPAIN AND PORTUGAL.*

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus	Height above High Water	Visible in Miles.	Year erected.
FUENTERRABIA. One bright fixed light, occasionally.	A small stone tower, 20 feet high, on Cape Higuera. The light only shown when the fishermen are at sea.		238	16	
PASSAGES. One fixed light.	Uncertain whether now shown.				1848
SAN SEBASTIAN. One bright fixed light.	On the Castle of La Mota on Mount Orgullo. Lighted from Sept 14 to May 3.	■	203	16	1836
SANTANDER. One bright revolving light every minute.	A tower, 102 feet high, on Cape Mayor.	■d	298	21	[illegible]
CAPE ORTEGAL. A bright revolving light.					
CORUNNA. One bright revolving light every 3 minutes.	On the ancient Tower of Hercules, 177 feet high.		304	20	1684 1847
CAPE FINISTERRE. Building.					1850
BAYONA ISLANDS. Building.					1850
VIGO. One bright revolving light every 3 minutes.	On the Castle of La Guia, 1½ miles N.E. of Vigo.	●	102	7	1844
VIANNA. Building.	On Monte Ouro.				1850
OPORTO. A revolving light every 6 minutes.	A yellow building, 66 feet high, at N. S. de Luz.	●	220	20	1834
AVEIRO. One revolving light.	Uncertain. Near the Pyramids.		70		
CAPE MONDEGO. Building.					1850
BERLENGAS. One bright revolving light every 3 minutes.	A square tower, 100 feet high, on the Great Berlenga Island.	■	365	25	1841
CAPE CARVOEIRO. One bright fixed light.	A square tower, 94 feet high, on the highest part of the cape.	●	182	15	1790

* The lighthouses of Spain will probably, ere long, be remodelled, as a large number of dioptric apparatus are now in course of preparation (1851).—ED.

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
CAPE ROCA. One revolving light every 1½ minutes, *red* and bright alternately.	A round tower, 52 feet high, quarter of a mile N.E. of the cape.	●	596	21	1772
GUIA. One bright fixed light.	A square tower, 96 feet high, at N. S. da Guia.	●	207	19	1771
SAN JULIAN. One bright fixed light.	A square tower, 120 feet high, in the fort.		128	12	1775 1848
BUGIO. One bright revolving light every 1½ minutes.	The round tower of Lourenzo, 70 feet high.	●	110	21	1775
BELEM. One *red* fixed light.	In a fort near the castle.	●	30	6	1847
CAPE ESPICHEL. One bright fixed light.	A square tower 100 feet high.	1 b	627	12	1790 1848
SETUBAL, or ST. UBES. A bright fixed light.	A round tower, 36 feet high, on Fort d'Outao, W. entrance of harbour.	●	490	6	1775
CAPE ST. VINCENT. One bright revolving light every 2 minutes.	On the convent.	●	221	30	1846
CAPE STA. MARIA. One bright fixed light.	On the cape.	1 b	109	15	1851
CADIZ. One bright revolving light every 2 minutes.	Tower of San Sebastian; a circular white tower, 127 feet high.	●	138	15	1794
TARIFA. One bright revolving light every 2½ minutes.	A white tower, 119 feet high, on the island S. of the town.	●	124	13	1813
GIBRALTAR. One brilliant fixed light.	From the Victoria tower, 60 feet high, on Europa Point.	1 b	150	15	1844

6. COASTS OF AFRICA.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
TANGIER; Centre	35 47 30	5 48 0	Don Vincente Tofiño, Don Luyando, and Lieutenant Arlett.
Cape Spartel; Pitch [1]	35 47 40	5 54 40	
Arzilla	35 29 30	6 0 0	Captain Washington and Lieutenant Smith, R.N., 1830.
El Araiche	35 12 50	6 9 0	
Old Mamora	34 52 30	6 25 0	Captain T. Boteler, R.N., 1828.
Mehedia	34 18 0	6 36 0	Captain Washington, R.N., 1830.
Faz, or Fez	34 6 3	4 58 15	Don Juan Badia y Leblich, otherwise called Ali Bey, 1804.
Mekinez	33 58 30	5 30 0	
Sla or Salee	34 2 45	6 45 30	Captains Boteler and Washington, 1828 and 1830.
Rabat	34 2 30	6 46 0	
El Mansoria [2]	33 46 10	7 20 0	Captain Washington and Lieutenant Smith, R.N., on the Mission to Morocco, 1829, 1830; and the Survey of Lieutenants William Arlett and H. Kellett, in 1835.
Point Fidallah	33 44 0	7 23 32	
Dar-el-Beida	33 36 30	7 35 24	
Azamor	33 17 37	8 15 0	
Mazagan	33 15 0	8 29 0	
Cape Blanco; North	33 8 0	8 38 0	
El Waladia	33 48 0	8 48 0	
Cape Cantin	32 32 27	9 14 50	
Asfee, or Saffi	32 18 15	9 12 0	Captain T. Boteler, R.N., 1828.

COASTS OF AFRICA—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
MAROCCO; Centre ····[3]	31 37 40	7 36 0	Don Juan Badia and Captain Washington.
SUERRAH, or MOGODOR··	31 30 30	9 46 0	Lieutenant Arlett.
Cape Tefelneh ··········	31 4 0	9 47 30	Captain T. Boteler, 1828.
Cape Ghir, or Geer ····[4]	30 38 0	9 53 0	The Chevalier de Borda, 1776.
Ras Aferni ···········	30 37 30	9 52 0	Observations of Lieutenants Arlett and Kellett, R.N., 1835.
Agadeer, or Santa Cruz ··	30 26 35	9 35 56	
Cape Aguluh ···········	29 49 0	9 48 0	
Cape Noon, or Inoon ····	28 45 45	11 4 10	
River Inoon; Entrance ··	28 17 0	11 32 0	The Chevalier de Borda, 1776.
Port Cansado; Entrance [4]	28 2 0	12 14 0	Lieutenant Arlett, &c., 1835.
Cape Juby ·············	27 57 50	12 51 0	
False Cape Boiador ······	26 25 15	14 12 30	
Cape Boiador, or Bojador ·	26 7 2	14 30 34	
Penha Grande; summit ··	25 7 6	14 50 53	The observations of Captain W. Fitzwilliam Owen, and those of M. le Baron Roussin, compared with those of the Chevalier de Borda. (*See Note* 4.) *** In 1830, Captain Belcher, by repeated observations, found Cape Blanco in latitude 20° 46′ 26″, longitude 17° 4′ 10″.
Seven Capes; Central Cape	24 41 12	15 0 30	
Angra dos Cavallos ······	24 8 12	15 36 18	
Rio do Ouro, or Gold River; Entrance, North Point··	23 36 18	15 58 30	
Cintra Bay; North Point··	23 7 0	16 9 15	
———— ; South Point ··	22 56 36	16 14 10	
Cape Barbas···········[5]	22 19 30	16 39 12	
Pedra da Gall; Centre····	22 12 30	16 48 4	
Cape Corvoeiro ······[6]	21 46 44	16 56 40	
Cape Blanco ···········	20 47 0	17 4 36	
Cape Mirik; the Down ··	19 25 0	16 32 0	
Tanit Bay; the Down ····	19 3 48	16 12 20	
Angel's Hillocks, Southern	18 29 30	16 2 0	
The Two Palm Trees of Portandik ·········[7]	18 18 54	16 2 12	H.M.S. *Esk*, Captain Purchas, 1826.
Down of Red Sand ······	17 25 0	16 12 0	Latitudes, Captain Roussin; Longitudes inferred by Chart, and *uncertain*.
Second ditto ···········	16 55 0	16 25 0	
Huts of Inguiagher ······	16 35 24	16 30 0	
St. Louis, Senegal; Lighthouse ···············	16 0 48	16 33 46	Captain (now Admiral and Baron) Roussin, in the years 1817 and 1818.
Bar of the Senegal; North Point ··············	15 55 18	16 32 40	
Little Paps, near Cape Verde; Northern one ········	14 56 24	17 6 10	
CAPE VERDE; extremity ·	14 44 30	17 32 0	Captain Roussin and M. Givry.
Almadia Rocks, off C. Verde Highest and Westernmost	14 44 29	17 33 30	Captain Fitzwilliam Owen.
Goree; the Lighthouse ·[8]	14 39 50	17 24 30	Captains Owen and Boteler.
Cape Naze, or Nose ······	14 31 30	17 7 20	
Portudal; Village ·······	14 27 18	17 3 12	Captain W. F. Owen, R.N., 1824.
Point Serine ···········	14 18 0	16 56 30	Captain T. Boteler, 1829.
Joal; Town ········ ···	14 10 0	16 49 45	Captains Owen and Boteler.
RIVER GAMBIA:—			
BATHURST TOWN; Flagstaff ··············	13 28 0	16 35 18	Survey of the River Gambia, from its Entrance to Pisania, by Captain Richard Owen, R.N., assisted by Messrs. E. O. Tudor and S. M. Mercer, 1826.
Bird Island; Flagstaff··	13 39 12	16 40 30	
CAPE ST. MARY····[9]	13 30 12	16 41 24	
James Fort ··········	13 9 40	16 22 12	
Tankrowell ··········	13 25 0	16 3 48	
Elephant Isle; West Point	13 26 30	15 20 36	

COASTS OF AFRICA—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
RIVER GAMBIA—*Contin.*			
Yamamaroo Town	13 42 0	14 58 30	Survey of the River Gambia, &c.
M'Carthy's Isle; Ft. George	13 33 0	14 45 30	
Pisania, or Pisaneea	13 32 54	14 34 18	
BALD CAPE	13 22 30	16 49 20	Captain Thomas Boteler, in H.M. sloop *Hecla*, 1829.
Point St. Pedro	13 7 15	16 48 0	
River Souta; Bird Islet	12 43 30	16 49 0	
River Casamanza; North Point of the Entrance	12 35 20	16 46 0	
Cape Roxo	12 21 0	16 44 40	
Breakers of Falulo; West Point	12 5 0	16 38 30	Captains Roussin and W. F. Owen, 1818, 1821, 1826.
Isle of Cayo; South Point	11 49 50	16 20 0	
BISSAO; Portuguese Fort	11 51 0	15 37 6	
BIJOOGA ISLANDS, &c.			
Papakawa Islet	11 36 30	15 54 12	Survey of the Bijooga Islands, and the adjacent Coast of Africa, by the officers of H.M. ship *Leven*, Captain W. F. Owen, 1826. *** In 1830, *Captain Belcher*, in H.M.S. *Ætna*, from his observations, made Pullam Island, South end, in 10° 51′ 53″ N., and 15° 45′ 5″ W.: the North end of Alcatraz in 10° 38′ 1″ N., and 15° 20½′ W: Sandy Isle in 10° 36′ 37″ N., and 14° 42′ 19″ W.—*Geog. Journal*, vol. ii. pp. 284, 291, 295.
Arcas Isle; Centre	11 41 15	15 39 0	
Bulola Town; Rio Grande	11 35 0	15 2 18	
Bulama Island; East End	11 34 42	15 30 24	
Bossessamé, or Tombelly; North Point	11 29 0	15 30 0	
S.W. Point	11 19 24	15 32 12	
Gallinha Isle; West Point	11 27 42	15 46 30	
N.E. Hog Island; E. Point	11 20 0	15 40 42	
Kanyabac; N.E. Point	11 18 4	15 43 0	
——— ; S.W. Point	11 10 12	15 48 12	
Orango; S.E. Point	11 3 12	15 55 12	
——— ; West Point	11 6 0	16 15 30	
South Breaker	10 56 18	15 57 40	
Pullam Island; South Point	10 51 42	15 45 6	
Alcatraz Islet; Centre	10 37 12	15 26 30	
Conflict Reef; Centre	10 30 0	15 11 0	
Rio Nunez; Entrance, Sand Isle	10 36 37	14 42 0	Captain Belcher.
——— ; Rebucko Town	10 57 0	14 21 48	Lieut. Austin, in the *African*, 1827.
Cape Verga; Summit	10 11 40	14 28 5	Captain Belcher.
Pongas River; Entrance	10 2 0	14 6 0	
Mount Kakulimah	9 45 0	13 28 0	
ISLES DE LOS:—			
Crawford I. Establishment	9 27 24	13 48 30	Captain W. F. Owen, in the *Leven*, 1826; confirmed by himself in the *Eden*, and by Captain Purchas in the *Esk*, 1827.
Tamara; Arethusa or North Point	9 31 0	13 40 30	
——— ; West Point	9 26 30	13 51 30	
Mataeong Island; Centre	9 14 0	13 25 30	
Yelleboa Island; Centre	8 55 42	13 17 45	
Parrot Island; Centre	8 53 0	13 15 0	
CAPE SIERRA LEONE; Extremity [10]	8 30 0	13 18 0	
SIERRA LEONE; King Tom's Point	8 30 6	13 14 30	
——— Freetown Citadel	8 29 42	13 14 18	
False Cape; Extremity	8 25 48	13 17 48	
Cape Chilling, or Shilling	8 9 30	13 10 12	Captain W. F. Owen, in the *Leven*, 1826.
Banana Isles; Highest Peak	8 5 48	13 16 12	

COASTS OF AFRICA—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Banana Isles; West Point.	8 5 0	13 15 12	
Plantain Islands; Gillmorris	7 55 12	13 0 12	
——; Bengal Rocks	7 54 36	13 2 48	
Tassa; Extreme Point	7 55 30	13 2 12	
Turtle Isles; North Isle; Centre	7 40 48	13 4 18	
Cape St. Anne; Extremity	7 34 0	12 57 0	Captain W. F. Owen, in the *Leven*, 1826.
Shoals of St. Anne:—			
Northern Extremity	7 56 0	(Not ascer-	
Southern Extremity	7 31 30	tained.)	
Western Limit	7 38 0	13 29 0	
York Isle, in Sherbro' River; Huts	7 32 0	12 26 42	
Shebar, Sherbro' River	7 22 48	12 31 30	
Boom Kittam River; Forks	7 14 24	12 8 36	
River Galinhas; Entrance	7 0 1	11 38 5	
Cape Mount, (1,046 feet); Western Beach	6 43 0	11 21 9	
St. Paul's River; Entrance	6 22 0	10 37 0	
CAPE MESURADO; Extremity	6 19 15	10 49 0	
——; the Cape Tree	6 17 29	10 49 25	
Junk River; Marshall, an American Settlement; Agent's House	6 8 6	10 22 45	
Monrovia; Govt. House	6 19 1	10 48 5	
Bassa; Director's House	5 54 50	10 4 5	
River Sestros, or Grand Cestos; South Entrance	5 26 25	9 34 45	
Baffou Point	5 9 10	9 17 30	
Bloo Bara, or Barbarra Factory; Simou	4 59 15	9 2 5	
Middle Neefoo, or Niffou	4 45 3	8 32 2	
CAPE PALMAS; Lighthouse	4 22 9	7 44 16	Captain A. T. E. Vidal, in H.M. ships *Etna* and *Raven*, 1835 to 1839.
Tabou	4 24 47	7 21 30	
Grand Bereby	4 39 3	6 54 30	
St. Andrew's River, King George's Town, within Swarton Corner	4 57 8	6 3 47	
River Fresco, or Rio de Lagos; off the Mouth	5 1 8	5 32 5	
Grand Lahou	5 8 3	4 57 40	
Jack Jaques	5 11 8	4 26 8	
Assinee River; Anchorage S.E. of the Mouth	5 3 5	3 12 7	
Apollonia	4 58 45	2 35 5	
Fort St. Anthony	4 52 18	2 14 45	
Cape Three Points	4 44 30	2 5 45	
Acquidah	4 45 27	2 2 8	
Dixcove	4 47 45	1 56 40	
Elmina, or St. George del Mina	5 5 0	1 22 30	
CAPE COAST CASTLE; *Lighthouse and Flagstaff*	5 5 26	1 12 5	

COASTS OF AFRICA—CONTINUED.

	LATITUDE.	LONGITUDE.	AUTHORITIES.
	° ′ ″	° ′ ″	
Mauree, or Moree; Flagstaff	5 7 30 N.	1 12 0 W.	Capt. W. F. Owen, in the *Eden*, 1827; and Capt. Purchas, in the *Esk*, same year.
Annamaboe; Flagstaff	5 10 12 —	1 7 12 —	
Cormantine; Flagstaff	5 10 30 —	1 5 36 —	
Tantumquerry; Flagstaff	5 13 30 —	0 46 48 —	*Lon. of Accra*, by 4 good chronometers of H.M. ship *Dryad*, Captain Hayes, in Feb., 1852, 0° 15′ 20″ W., lat. 5° 32′ 27″ N.
——— Extreme Point	5 12 30 —	— — —	
Devil's Hill; Summit	5 18 36 —	0 39 0 —	
Barracoe; Point	5 29 0 —	0 24 0 —	
Accra; British Flagstaff	5 32 0 —	0 11 30 —	Captain Vidal.
———	5 32 0 —	0 18 12 —	Captain Purchas
Ningo; Fort	5 45 0 —	0 1 48 E.	Captains Owen and Purchas.
Volta River; Entrance	5 47 18 —	0 42 18 —	Captain Kelly, in the *Pheasant*.
Cape St. Paul	5 44 30 —	0 52 18 —	Captains Owen and Purchas.
Quitta; Flagstaff	5 54 36 —	0 54 18 —	Captain B. M. Kelly.
———	5 55 0 —	0 55 48 —	Captain Purchas.
Padiana; Town	5 57 42 —	0 57 18 —	Captain B. M. Kelly.
Little Popoe; Road	6 13 0 —	1 36 0 —	
Grand Popoe; Road	6 19 0 —	1 46 0 —	
———	6 16 0 —	1 43 48 —	Captain Purchas, in H.M.S. *Esk*, 1827.
Whydah, or Ajuda	6 19 30 —	2 5 0 —	
——— (*Say* 2° 5′ E.)	6 19 0 —	1 59 48 —	
Appee	6 22 0 —	2 25 0 —	
Porto-Novo; Hill	6 20 0 —	2 34 0 —	
———; Road	6 19 0 —	2 34 0 —	
Badagry; Mount	6 24 0 —	2 43 30 —	
———; Road	6 20 0 —	2 47 48 —	
Lagos River; Entrance	6 24 0 —	3 22 0 —	
———; End of the Sandy Beach	6 20 0 —	4 27 0 —	
Benin River; N.W. Point	5 43 0 —	5 4 0 —	Captain Vidal.
Rio dos Esclavos	5 34 0 —	5 5 48 —	Captain Purchas.
Terra Formosa; West Point	4 28 0 —	5 41 30 —	Captain A. T. E. Vidal, in H M. sloop *Barracouta*, 1826. (*Longitude of the Bar of the Quorra, Captain William Allen*, 1833.)
———; Eastern Point	4 19 24 —	5 54 33 —	
River Nun or Quorra, the Bar (2 *fathoms*) [11]	4 15 0 —	5 55 0 —	
Rio Bento, or Second River	4 17 0 —	6 15 0 —	Captain Vidal, in the *Etna*, and Captain Purchas, in the *Esk*, 1827; and Captains Vidal and Boteler, 1826.
Rio St. Nicolas, or Third River	4 18 0 —	6 24 0 —	
New Calabar River; Foche Point	4 22 40 —	7 0 0 —	
Bonny River; Rough Corner	4 23 40 —	7 7 0 —	
Old Calabar River; Tom Shot's Point, West of the Entrance	4 36 0 —	8 19 0 —	
Backasey Gap; East of the Entrance	4 29 0 —	8 32 0 —	
Bimbia Isle	3 57 0 —	9 13 48 —	
Cape Camaroens	3 53 0 —	9 0 0 —	
Camaroens Mountain; Peak	4 13 0 —	9 12 0 —	
Bumby Mountains; Highest Peak	4 57 0 —	9 18 0 —	
Qua Mountain	5 15 0 —	8 51 0 —	
Corisco Island; N.W. Point	0 55 54 —	9 19 45 —	
Cape Esterias	0 37 48 —	9 21 0 —	
Point Clara	0 30 30 —	9 20 30 —	
Cape St. John	1 9 40 —	9 21 35 —	
Gaboon River; Round Corner	0 18 5 —	9 20 0 —	
Cape Lopes	0 36 12 S.	8 45 17 —	

COASTS OF AFRICA—CONTINUED.

	LATITUDE.	LON. E.	AUTHORITIES.
AFRICAN ISLANDS.	° ′ ″	° ′ ″	
FERNANDO PO:—			
Clarence Peak	3 35 0 N.	8 46 30	Captain Vidal.
Cape Bullen; Northern Extremity	3 47 25 —	8 39 24	
Adelaide Islet	3 34 48 —	8 47 17	
Point William; Flagstaff	3 45 36 —	8 47 0	Captain W. F. Owen, in the *Eden*, 1827.
Cape Horatio; N.E. Extremity	3 46 15 —	8 54 24	
Cape Vidal; E. Extremity	3 39 18 —	8 56 18	
Cape Barrow; South Rock	3 11 30 —	8 40 0	
Cape Eden; S.W. Extremity	3 15 30 —	8 25 6	
Cape Badgley; West Extremity	3 19 42 —	8 24 42	
Charles' Folly; N.W. Extremity	3 26 48 —	8 27 42	
Goat Isle; Centre	3 31 0 —	8 32 48	
PRINCES' ISLAND; the Brothers near	1 23 0 —	7 19 48	Captains Purchas and Kelly.
ST. THOMAS'S ISLAND:—			
Cabrita Isle	0 27 0 —	6 45 0	
Anna de Chaves; Road	0 25 30 —	6 46 0	
Rolas' Isle (*on the Line*)	0 0 0 —	6 36 30	H.M.S. *North Star*.
ANNOBON; East Point	1 25 0 S.	5 42 48	Captain Purchas.

NOTES.

1. CAPE SPARTEL.—In the *Connaissance des Tems*, this cape is stated to be in lat. 35° 48′ 40″, and lon. 5° 53′ 1″. In the Requisite Tables it is stated to be in lat. 35° 46′ 0″, lon. 5° 57′ 12″. The remarks of the late Mr. William Chapman, master of H.M.S. *Illustrious*, appear to confirm the longitude of Tofiño, from whom he differs only 40 seconds in latitude, which he represents as so much more to the southward. The observations of Captain Smyth give the lat. 35° 47′ 15″, and the lon. 5° 55′ 45″, by chronometer and lunars. The coast, from Cape Spartel to Cape Bojador, was surveyed in the *Etna* and *Raven*, under Lieutenants Arlett and Kellett, 1835, as afterwards noticed.

2. EMPIRE OF MAROCCO.—The points determined by Captain Washington we owe to an excellent paper, entitled "*Geographical Notice of the Empire of Marocco; by* Lieutenant Washington, R.N.," given in the first volume of the "*Journal of the Royal Geographical Society*," 1831; a communication replete with interesting and useful information, and quite a model for future travellers.

3. CITY OF MAROCCO.—The scientific traveller, Don *Juan Badia*, commonly called *Ali Bey*, from his observations in 1803-4, gave the centre of Marocco as in 31° 37′, and 7° 35′ 30″. On reference to the Astronomical Journal of Captain Washington, there appear upwards of 100 sights for determining the longitude of the city. Distances between moon and sun; moon, and stars East and West of her; and altitudes of the moon when in the prime vertical,—the mean results of which give the longitude of a garden at the S.W. angle of the city: lon. 7° 36′ W.; lat. 31° 37′ 20″; mean of about 20 mer. alts. of the sun. *Variation*, from numerous observations by Schmalcalder's compass, 20½° W.—*Geographical Journal*, vol. i. pp. 140, 141.

4. CAPE GEER, &c.—M. le Chevalier Jean Chas. de Borda was charged, in 1776, by Louis XVI., with a commission to the Canary Islands and the Coast of Africa, for the express purpose of making observations, and determining the chief points of the Canary Islands, &c. He was furnished with timekeepers, by which he ascertained the positions,

as they have appeared in different Charts and Tables. On this expedition, M. de Borda, in the ship *La Boussole*, was accompanied by the *Espiègle*, M. le Chastenet Puysegur, who afterwards composed the Pilot for St. Domingo; also by Captain Don Josef Varela, and another intelligent officer of the Spanish marine; all of whom assisted in the operations. The results proved to be numerous and important; and they served for the general rectification of the coast as far to the southward as Cape Verde.

But, in the years 1817-18, Captain (now Baron) Roussin was employed by the French Government in surveying the coast between Cape Bojador, in 26° 7′ N., and the Isles de Los, in 9½°; and this officer has given, most satisfactorily, many points not before ascertained.

Again, in 1820 and 1821, Captain William Fitzwilliam Owen, in H.M.S. *Leven*, was commissioned by the British Admiralty to examine and settle the coast from Cape Noon southward: and his observations have still farther, and in a much more important degree, tended to perfect the hydrography of Western Africa. To Captain Owen's work, therefore, we refer most particularly in the Tables; and have only to add that there is a remarkable coincidence, in general, in the results of the two commanders; and that even in comparing either with those of M. de Borda, the differences, practically considered, are of little moment.

A partial survey of the eastern range of the Canary Islands, and the continental coast thence northward to Cape Spartel, was made by Lieutenants William Arlett and H. Kellett, commanders of the *Etna* and *Raven*, in 1835; the particulars of which are given in the "Journal of the Royal Geographical Society," vol. vi., 1836, and from these we derive the corrected positions given in the Table, as more fully shown hereafter.

5. Cape Barbas.—In the Admiralty translation of M. Roussin's Memoir (page 17), the longitude of Cape Barbas is misprinted 17° 30′.—M. de Borda made it 16° 39′ 45″; Captain Owen, 16° 39′ 12″, as in the Table.

6. Cape Corvoeiro.—We assume as Cape Corvoeiro a point in 21° 46′, according to M. Roussin, and not 21° 13′, as given by Captain Owen. The longitude in the translation of M. Roussin's Memoir is misprinted as 19° 14′ 55″, which is, we presume, the Paris longitude = 16° 54′ 33″ from Greenwich.

7. Portandik.—The two palm trees are the first seen in sailing hither from Cape Bojador. Portandik is supposed to have been situated about a mile to the southward of this spot, but not a vestige of it remained in 1818, when it was visited by Captain Roussin.—*See the description in* Section III. *hereafter.*

8. Goree.—The position formerly given was 14° 40′ 10″ N., and 17° 24½′ W., from the observations of M. Fleurieu, 1769, and of MM. de Verdun, Borda, and Pingré. Captain Boteler, in 1829, made it the same. The *Argo* frigate, Captain Hallowell, 1802, gave the lat. 14° 39′, and lon. 17° 24′ 58″.

9. Cape St. Mary.—From observations in H.M.S. *Esk*, Captain Purchas, in 1826, the position of Cape St. Mary has been given at 13° 29′ N., and 16° 45′ 12″ W.; Bird Island at 13° 40′ N., and 16° 44′ 12″ W. The results show that the points lie at least as far to the West, as shown by the survey.

10. Sierra Leone, &c.—In preparing the former editions of this work, we collected a large number of observations, which had been made, from time to time, on the coast of Guinea, &c., between Sierra Leone and Cape Lopez: they included those previously given by the officers of H.M. ships *Argo*, *Amelia*, *Inconstant*, *Tartar*, and others; and we finally appended to such as we selected for the tabular statement the following remarks:—"Although we have paid the utmost attention in the comparison of different results, charts, and descriptions, as shown in the Tables and Notes, we are by no means satisfied with the conclusions as to many points eastward of Cape Palmas and St. Andrew's Bay. Indeed, all that has yet been done by the king's officers, and others, prove only the necessity of a new series, in order to establish so much as may be correct, and to rectify so much as may not be so." Happily, such rectification has taken place, and many doubts, even on the most important points, have recently vanished.

We give a specimen, on the longitude of Cape Sierra Leone. Many years ago, the late Sir George Young gave the longitude of this cape as 12° 33′ 47″; the French Tables afterward, as 12° 54′; the Requisite Tables, 13° 9′ 17″; H.M.S. *Argo*, 1802, as 13° 12′; the *Inconstant*, 1816, the same; the *Amelia*, in 1812, 13° 17′ 30″; the *Leven* (Captain Owen), in 1826, 13° 18′ 0″; the *Eden* (Captain Owen), in 1827, 13° 18′ 10″;

Captain Sabine, Royal Artillery, in 1822, 13° 19′ 0″; and Captain Purchas, in 1827, 13° 19′ 12″. Hence we adopt Captain Owen's longitude, as given in the Table. It may be added, that Lieutenant Raper assumes the North Battery to be in 13° 14′ 30″, or nearly as in the Table.

By 318 lunar distances (23 sets), taken in the West Bastion of Fort Thornton, at Freetown, Captain Sabine, in 1822, made the longitude of that spot 13° 15′ 11″ W.; and in 1827, Captain Owen, in the *Eden*, made that of the Victualling Office 13° 14′ 30″. Latitude of the latter, 8° 30′ 6″; of Fort Thornton, by Captain Sabine, 8° 29′ 21″.

"*Fort Thornton* stands on the highest ground in its own immediate neighbourhood, excepting a small hill on which a martello tower is built, at a distance rather exceeding a quarter of a mile: the situation of Freetown, however, may be more generally stated to be at the foot, on the northern side of the range of mountains, which, coming from the interior, finds here its termination in the sea, and gives the name to the cape, harbour, and colony of Sierra Leone: the general height of the range, so far as it has yet been explored, is from 2,000 to 3,000 feet. The principal geological feature in the neighbourhood of Sierra Leone is a red granite, of easy and rapid decomposition."—(*Captain Sabine's Notes.*)

COAST OF GUINEA, between CAPE THREE POINTS and CAPE LOPEZ, including the ISLANDS. Although we described this portion of coast in the *New Directory for the Ethiopic or Southern Atlantic Ocean* (1845), we have considered it proper to continue the series of points in the Table; and for a description of the coast, and remarks upon the positions, we refer the reader to the above work.

11. RIVER QUORRA.—This important river is described in the Directory mentioned in the preceding note. In the beautiful Chart of it, by Captain William Allen, published in 1837, the East point of the entrance, formerly given by mistake in 6° 4′ E., is laid down in lat. 4° 20′ N., and lon. 5° 55′ E. The bar, with 2 to 4 fathoms over it, extends 2 leagues southward from the mouth of the river, which demonstrates the strength of the ebb tide. Within the bar, in an extent of 4 miles, the depths are 6 and 7 fathoms, but diminishing thence upward. The town of *Eboe* or *Ibu*, on the western bank of the river, is in lat. 5° 41′, lon. 6° 26½′: *Damoogoo*, or *Ada-mugu*, on the eastern bank, in lat. 6° 30½′, lon. 6° 48½′: *Attah*, on the East side of the river, lat. 7° 6′, lon. 6° 58′: *Mount Purdy*, on the East, below King William's range, lat. 7° 24½′, lon. 7° 3′: *Mount Franklin*, on the same side, lat. 7° 37′, lon. 7° 4′: confluence of the *Quorra* and *Tchadda*, lat. 7° 47′, lon. 7° 6′: *Kakanda*, on the West, lat. 8° 22′, lon. 6° 54′: *Egga*, on the same shore, lat. 8° 43′, lon. 6° 41′: *Rabba*, on the East, the termination of the survey, lat. 9° 14′, lon. 5° 27′.

VARIATIONS OF THE COMPASS.—At Ceuta, in 1811, the variation was found to be 22½° W., and continues nearly the same. At Cape Spartel, 22°. Between Cape Spartel and Saffi Bay, it is, at present, from 22° to 21° W.: at Morocco, in 1804, it was found to be 20° 38′ 40″ W.: between Saffi Bay and the Canary Islands it is 21°. In 1835, at Mogador, it was 19½°; and at Cape Noon, 19°. Near Cintra Bay, in 23° 5′, it was 19¼° in 1817: near Cape Blanco, 18° 9′: Bar of the Senegal and Goree, 17¼°: Cape Roxo, 17° 20′: Bissao and mouth of the Rio Grande, 17° 30′: Isles de Los, in 1826, 18°: off Cape Palmas, in 1820, 18° 50′: in the neighbourhood of Cape Mesurado, in 1839, 19° 30′: off Cape Three Points, and thence to Benin Bar, 19° W.: mouth of the Quorra, 1833, 20° W.

THE PHAROLOGY OF AFRICA.

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water	Visible in Miles.	Year erected.
SENEGAL (French). One bright fixed light.	On the government house, Ile de St. Louis.	●		6	
GOREE ISLAND (French). *One bright* fixed light.	On the Fort of Goree.	●		6	

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
SIERRA LEONE (English). One bright fixed light.	A building, 69 feet high, on the cape.	●		12	1849
CAPE MESURADO (Liberian). One bright light.		●	240	15	
CAPE PALMAS (Liberian). One bright revolving light every minute.	On the cape.		100	15	
CAPE COAST CASTLE (English). One bright fixed light.	A white circular stone tower, 46 feet high, on Fort William, 600 yards inland.	●	350	20	1835 1847

7. THE AZORES, OR WESTERN ISLANDS.

(*Originally* Ilhas dos Açores, *or* Isles of Hawks.)

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Formigas, or Ants:			
Middle of the greatest ...	37 16 50	24 54 3	
Santa Maria, or St. Mary:			Mons. C. P. Claret-Fleurieu, 1769; Don Vincente Tofiño, 1788; and Captain Vidal, 1844.
Punta do Castello, or S.E. Point	36 56 47	25 5 45	
Town of St. Mary	36 58 0	25 12 18	
Point de Maldemarenda, or S.W. Point ......[1]	36 57 31	25 14 3	
San Miguel, or St. Michael's:			Remarks.
Ferraria, or West Point...	37 54 15	25 55 15	The longitude of St. Michael's is given from Tofiño's separate result, which is more easterly than that of Fleurieu. Captain Livingston, from four sets of lunar distances, taken on board the *Asia*, 4th and 5th October, 1818, made it a little to the eastward of the position given in the table.
City of Ponta Delgada ...	37 45 10	25 41 15	
Punta de la Marquesa, or East Point ....[2]	37 48 10	25 10 5	
Terceira:			
Mount de Brasil, near Angra	38 38 33	27 12 33	
St. George:			But Captain Fitzwilliam Owen has stated, in his "Memoir," that the longitudes, as annexed, were examined and *proved to be correct*, by H.M. ship *Leven*, in 1820.
Pta. del Topo, or S.E. Pt.	38 29 22	27 50 27	
Graciosa:			
Fort at Praya	39 3 5	27 59 0	
Pico:			
The summit of the Peak .	38 26 15	28 27 58	
Fayal: The S.E. Point, or Morro de N.S. de la Guia	38 30 12	28 41 37	
Flores: Sta. Cruz Fort [3]	39 27 3	31 8 37	Captain A. T. E. Vidal, 1842.
Corvo: the Southern Point, or Pta. del Pesqueiro-alto	39 40 7	31 8 0	

NOTES.

1. Azores.—The voyage of M. Fleurieu, in the *Isis* frigate, made in 1768-69, and published in 1773, has furnished several observations of the points of the Azores, as shown by the marine clocks of M. Ferdinand Berthoud, and verified, in great measure, by more numerous observations of Don Vincente Tofiño, made in 1788. The difference

in the results of these two observers is generally inconsiderable; so small, indeed, that it may rather be considered as an agreement.

M. Fleurieu ascertained the position of the Mount of Brasil, near Angra, in Terceira, to be 38° 38′ 37″ N., and 27° 12′ 27″ W. Tofiño's result was 38° 38′ 10″, and 27° 12′ 40″; a remarkable coincidence, considering the distance of time at which the observations were made. The longitude of this spot was, therefore, assumed by the Spanish commander, as the meridian referred to from the points subsequently determined. The summit of the mount, as lately given by Captain FitzRoy, R.N., is in 38° 38′ 35″, and 27° 12′ 54″.

Captain Alexander T. E. Vidal, R.N., who has been surveying these islands, makes the Fort at Villa do Porto, in St. Mary's, in lat. 36° 56′ 30″, and lon. 25° 9′ 45″ W.

2. St. Michael's, &c.—In our former statements we noticed the erroneous positions of St. Michael's, Terceira, &c., which had, from time to time, appeared in the *Requisite Tables* and *Connaissance des Tems*; but, as the doubts have vanished, it would be no longer useful to repeat those remarks. Captain FitzRoy gives St. Bras Castle, near Ponta Delgada, at 37° 43′ 58″, and 25° 40′ 15″.

3. Flores and Corvo.—The longitudes of these islands were given according to the results of Tofiño; they differ slightly from those of Captain Vidal as now stated. *Vide* the Chart of the Azores, Canary Islands, and opposite coasts, with the harbours, &c., constructed by the editor, and published by the proprietor, of this work. The late Sir Home Popham, from several observations, lunar and chronometric, inferred the longitude of the North Point of Flores as 31° 11′, or 2′ 45″ more to the westward than the position assigned by Tofiño.

VARIATION of the COMPASS.—At St. Michael's, in 1826, the variation was 24° 15′ W. At Flores, 19° W. Captain Livingston, by means of many observations, near Ponta Delgada, found it about 25° W., in 1818. This gentleman properly observes, that differences may be ascribed to the volcanic commotions and ferruginous nature of the country. See Note on the Variation at Tenerife, hereafter.

LIGHTHOUSES.—The lighthouses of the Island of St. Michael, *such as they are*, will be found described in a note on that island hereafter.

8. THE MADEIRA AND CANARY ISLANDS.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Madeira:			
Town of Funchal, British Consul's Garden ...[1]	32 38 0	16 54 45	Captain Matt. Flinders, H.M. ship *Investigator*, 1801; Gen. Sir Thomas Brisbane, 1821.
Punta del Pargo, the West Point	32 49 0	17 15 54	Captain W. Fitzwilliam Owen, 1820, 1827.
Brazen Head; S.E. extremity	32 37 18	16 51 42	
Pta. de S. Lorenzo, the East Point	32 43 54	16 38 12	
Porto Santo: The Village on the South Side......[2]	33 3 30	16 20 3	Captain A. T. E. Vidal, 1844.
The Salvages:			
Middle of the Great Salvage ....[3]	30 8 30	15 54 36	
Lanzarota, or Lançerote:			
Allegranza Isle, off the North end	29 25 30	13 30 30	
Port de Naos................	28 58 30	13 32 30	
Fortaventura:			
Isle of Lobos, Pt. Martino	28 45 30	13 48 30	
[illegible]	[illegible] 2 0	14 31 0	

THE MADEIRA AND CANARY ISLANDS—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
CANARIA, or GRAND CANARY:			
The Isleta, or N.E. Point	28 11 0	15 25 0	Captain A. T. E. Vidal, 1844.
Point Arguineguin, the South Point	27 44 55	15 40 10	
Point Aldea, the W. Point	28 1 0	16 0 30	
TENERIFE, or TENERIFFE:			
Mole of Santa Cruz...[4]	28 28 33	16 17 14	
Le Pic, or the Peak	28 16 35	16 38 2	
L'Orotava (N.W. side) ...	28 25 0	16 33 0	
GOMERA:			
The Port	28 8 0	17 5 55	
PALMA:			
Sta. Cruz, on the East side	28 40 30	17 44 28	
Tasacorta, on the West side	28 38 12	17 55 55	
FERRO:			
Port Hierro	27 46 30	17 54 22	
Point Orchilla, S.W. Point	27 42 20	18 9 45	

NOTES.

1. FUNCHAL.—The latitude of Funchal is well ascertained. The longitude was estimated by M. Bory, in 1772, at 16° 56′, as it has since stood in the French Tables. Captain Horsburgh, in his first edition, states that he found it, by good chronometers, 17° 6′; and Mr. Wales's observations, by timekeeper, in 1772, gave it 17° 6′ 22″. It is at length unnecessary to repeat the varying results of other observers, the differences having been decided by our late respected countryman, Captain Flinders; from whose observations, in H.M. ship *Investigator*, 1801, the latitude of the road appeared to be 32° 37′ 44″, and the greatest longitude, by any of six timekeepers, 16° 54′ 26″. "This was given by Earnshaw's watch, No. 465, which had kept an uniform rate during fifteen months previously to its being brought on board. We made use of this watch to reduce some lunar observations taken a few days before arriving at, and others after sailing from, the place of anchorage; and the result was as follows:—

"Ten sets of distances, East and West of the moon, taken by Mr. Crosley, in Funchal Bay, and afterward with a Troughton's sextant, 16° 59′ 21″.

"Eight sets, East and West, taken by me with a Troughton's circle and two sextants, before and afterward, 16° 51′ 28″."

Hence, West longitude of Funchal, by lunar observations—*Mean*, 16° 55′ 24″. The *variation*, in 1811, was 21° West.

After the above was written, we were informed by Mr. William Smith, the gallant master of H.M. ship *Asia* (since killed in the battle of Navarino), that, by observations taken in H.M. ship *Ganymede*, 9th August, 1818, Funchal Roads appeared to be in 32° 37′ 33″ N.: longitude, by chronometer, 16° 55′ 30″; by lunars, 16° 57′ 15″. Mr. J. Town, master of the *Salisbury*, in February, 1816, made the longitude, by chronometer, 16° 55′ 42″.

His Excellency Sir Thomas Brisbane, on his voyage to New South Wales (1821), obtained his time at the house of Mr. J. W. Gordon, at Funchal, by four excellent chronometers, by which the mean longitude was concluded as 16° 54′ 36″. At the same time the latitude of the tower, on Mr. Gordon's house, was found to be 32° 38′ 19·7″, and that of the Loo Rock 32° 37′ 53·8″. The longitude given by Sir Thomas Brisbane was confirmed by ten Admiralty chronometers, under the care of Dr. Tiarks, in 1823, which gave for the longitude of the British Consul's garden 16° 54′ 45″ (in time 1^h 7′ 39″), the position given in the Table.

Captain Fitzwilliam Owen, from observations in H.M. ship *Leven*, in 1820, gives the landing-place, near the Loo Castle, in 32° 37′ 42″ N., and 16° 55′ 30″ W.

DESERTAS.—Captain Flinders states the southern end of the Bujio to be in latitude 32° 24′ 20″, which differs less than a mile from its position as previously given on the charts; and he discovered a small ledge of rocks projecting from under the cliffs at the S.W. part of this island. Captain Owen gives the North end of the Northern Deserta in 32° 36′ 30″ N., and 16° 33′ W. The South end of the Southern Isle (*Bujio*) he gives in 32° 28′ 30″ N., and 16° 31′ 18″ W. It may probably be rather more eastward, but certainly not more West.

2. PORTO SANTO.—A plan of this island, from a survey by Lieutenant-Colonel Roberts and Captain Thomas Wolley, of H.M. ship *Arethusa* (1802), states, in general terms, the latitude of the town to be 33° 2′, and its longitude 16° 35′, which is only twenty minutes East of the meridian of Funchal. But, in the former edition of this work, upon a comparison of this statement with the different Tables and Charts, it was considered that the difference should be at least thirty-seven minutes, and it was assumed in the Table. This has been in a measure confirmed by the recent observations of Captain Vidal, whose position is that given, the difference being 34′ 42″. See the Chart of the Azores and Canary Islands, before mentioned. The Requisite Tables and *Connaissance des Tems* give the latitude of the middle of the isle 36° 5′, and the longitude 16° 14′ 51″, and 16° 17′ 30″. Captain Owen gives the governor's house in 33° 2′ 54″ N., and 16° 18′ 48″ W.

3. THE SALVAGES.—The longitude of the Great Salvage, as lately furnished by five British East India Journals, differs from 15° 34′ to 16° 1′. The mean result of these is 15° 48′ W. Yet we have not deemed this evidence sufficient to cause a deviation from the position assigned in the Table.

M. La Pérouse has observed: "We were employed on the 18th of August, 1785, in taking observations off the Salvage, and I think its longitude may be fixed in 18° 13′, (15° 53′ from Greenwich), and its latitude 30° 8′ 15″."

Captain Wm. Mudge, R N., who, with Captain Vidal, surveyed the Great Salvage in 1820, places its South side in 30° 7′ 39″ N., and 15° 56′ 18″ W.: and he says of it—"This island is obviously of volcanic origin, and consists principally of a dark-coloured black rock, the detached parts of which, as well as the whole, exhibit strong marks of fixed magnetic polarity. Even the dust of the roads, and of the floors of the cottages, has the same character as the rock itself, and may gathered up, like steel filings, by means of a bar magnet.

"The compass was singularly deranged at the three stations taken on the survey, and the extreme difference in its variations amounted to about 72° at a less distance than a mile. At the first station, one morning, Mr. Durnford, one of the party, laid down his watch, and on returning to the same place again it was found that the watch had gained two hours in the interval, an acceleration due to the magnetic action of the rock upon the balance."

4. TENERIFE.—The position of Sta. Cruz in the Table is that given by Captain Vidal, in his completion of the survey of these islands (1844). The previous observations have placed the longitude generally one or two minutes more, or to the westward of those in the Table.

M. La Pérouse says, "Several observations were made at Santa Cruz, in Tenerife, which we think may be fixed at 18° 36′ 30″ (16° 16′ 6″ from Greenwich), and 28° 27′ 30″ N." In 1817, the Baron Roussin, of the French Navy, placed the Mole Head of Santa Cruz in 28° 27′ 58″ N., and 16° 16′ 0″ W.; and from this meridian he deduced, by chronometers, the longitudes of all the coast between Cape Boiador and the Isles de Los, which have already been described.

Captain Fitzwilliam Owen, from his observations in the *Leven*, 1820, gives the Mole Head in 28° 27′ 54″ N., and 16° 15′ 0″ W. The Peak he gives in 22° 16′ 24″ N., and 16° 39′ W.

The general mean of the longitude of the Mole of Santa Cruz, from the observations of Captains Pérouse, Bligh, Vancouver, and Krusenstern, of M. Quenot, and the Baron Alexander de Humboldt, is 16° 15′ 18″.

VARIATIONS OF THE COMPASS.—Between Porto Santo and Madeira, the mean variation is about 22°. In the road of Santa Cruz, Tenerife, it is rather less, if we may conclude that it has been correctly ascertained; but M. de Humboldt has noticed that the variation differs several degrees, according to the place where the observation is

made, at the Mole, or at several points to the North, along the shore; and, he adds, we must not be surprised at these deviations in a place surrounded by volcanic rocks. "I remarked, with M. Gay-Lussac, that, on the declivity of Vesuvius, and the inside of its crater, the intensity of the magnetic forces is modified by the proximity of the lavas."—(*Personal Narr.*, vol. i. p. 117.) Captain Owen gives the variation at Porto Santo at 23½° W.

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9. THE CAPE VERDE ISLANDS.

POSITIONS OF PLACES.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Sal or Salt Island: [1]			
The North Point	16 51 0	22 54 34	
The South Point	16 34 0	22 56 4	
Bonavista:			
The N.W. Point	16 13 20	22 55 44	
The N.E. Point	16 11 0	22 42 34	
The New Town............	16 7 0	22 55 34	
The South Point	15 57 0	22 48 44	
Leton Rock	15 48 0	23 9 4	
Mayo, or Isle of May: [2]			
The North Point	15 19 30	23 12 4	
English Road	15 7 30	23 13 4	
South Point	15 6 40	23 10 4	
Island of St. Iago:			
Bighude, or North Point	15 19 30	23 45 34	The Survey of the Cape Verde Islands, by Lieutenants (since Captains) Vidal and Mudge, R.N.; taken by order of the Lords Commissioners of the Admiralty, in the years 1819, 1820, and 1821, compared with the observations of Captains King, Foster, Owen, &c.
East Point.................	15 0 30	23 25 56	
Porto Praya, Quail I....[3]	14 53 40	23 30 34	
S.W. Point	14 58 30	23 44 56	
Island of Fogo:			
North Point	15 1 15	24 22 0	
Town of N.S. da Luz ...	14 53 0	24 31 0	
Brava:			
Road on the West side...	14 48 0	24 43 34	
St. Nicolas:			
East Point.................	16 34 30	24 0 0	
North Point	16 42 0	24 21 20	
West Point	16 38 0	24 27 0	
South Point	16 28 30	24 19 0	
Raza: East Point...........	16 38 0	24 38 30	
St. Lucia:			
East Point.................	16 46 0	24 42 0	
North Point	16 49 0	24 47 30	
St. Vincent:			
Porto Grande............	16 54 0	25 1 0	
St. Antonio: [4]			
North Point	17 12 0	25 6 45	
West Point................	17 4 0	25 23 10	
South Point	16 55 0	25 19 25	
East Point.................	17 5 30	25 0 5	

NOTES.

1. **Sal.**—A particular description of Sal, and all the other islands, will be found in our Third Section, hereafter.

2. **Mayo.**—In the course of the year 1819, while surveying the Island Mayo, Lieutenants Vidal and Mudge found the hills upon which they were carrying on their

operations so strongly magnetic, that the needle belonging to the theodolite became wholly useless; the dip increasing so much that the needle could not traverse, in consequence of one end of it being drawn down to the face of the instrument, &c.

3. Porto Praya.—The longitude of this place appears to be well determined; particular attention having been directed to it by many of our most skilful navigators. Captain FitzRoy places the West point or landing-place on Quail Island (called also Gun Point), at Porto Praya, in lon. 23° 30′ 0″ W. Captain P. P. King had made it 23° 30′ 17″; Captain Vidal, 23° 31′ 28″; and Captain Owen, 23° 31′ 3″; therefore 23° 30′ 34″, the longitude formerly assigned to it by Mr. Purdy, in previous editions of this work, cannot be far from the truth: this was deduced from the observations of Messrs. Fleurieu, Borda, Verdun, &c., of Mr. R. Keilor, Captains P. Heywood, Mortlock, &c.

4. St. Antonio.—Commodore (now Admiral) Von Krusenstern, in the relation of his voyage round the world, says, "On the 6th of Novemoer (1803), at day-break, we perceived the Island of St. Antonio, at the distance of from 25 to 28 miles. As the wind was moderate, I held directly to the westward, to keep still more away from the land, as calms are very frequent in the neighbourhood of lofty islands. At noon we had an observation in lat. 17° 55′. The S.W. point of the island bore, at the time, S. 24° E., distant about 45 miles. I now steered W.S.W., and as the wind freshened toward the evening, S.W. by W. The next day, at noon, the S.W. part of the Island of St. Antonio bore 86°, distant about 54 miles; and I again held S.S.W.

"The mean of a variety of lunar observations, taken this morning, made our longitude, reduced to mid-day, 26° 17′ 7″. By the watches it was 26° 24′ 20″. I reckoned the longitude of the S.W. point of St. Antonio, by Arnold's large timepiece, No. 128, the best of our chronometers, 25° 24′ 0″."—(*Mr. Hoppner's Translation*, p. 53.)

Captain Flinders, in the relation of his voyage (vol. i. p. 26), has said, that he found the variation near the western side of St. Antonio, on the evening of the 14th August, 1801, before making the land, 13° 51′; and the next evening, 13° 3′, when 4 leagues to the westward. He had not an opportunity of making observations to determine the situation of the island, but, according to his estimation, it would appear to be even more to the *eastward* than the situation now assigned; as he supposed the high land near the S.W. point to be in 25° 12′ W.

Captain King made Terrafal Bay, at the S.W. end, by eleven chronometers, in lon. 25° 20′ 1″; Captain Owen made it 25° 21′ 42″, and Captain Foster, 25° 22′ 56″: therefore, from these it will be about 25° 21′ 30″; and the West point, 25° 23′ 10″.

For further information, see the Chart of the Cape Verde Islands, *second edition*, published by the proprietor of this work; and see, also, the description of St. Antonio, hereafter.

VARIATIONS.—In 1826, the variations of the compass near St. Antonio were found to be near 16°; at Port Praya, St. Iago, 15° West. The *mean* variation allowed by Captains Vidal and Mudge, is 14°.—*Lighthouses*, none.

10. GREENLAND, LABRADOR, AND NEWFOUNDLAND.

POSITIONS OF PLACES.

	LAT. N.			LON. W.			AUTHORITIES.
	°	′	″	°	′	″	
GREENLAND.							The Chart of Greenland, published by authority at Copenhagen, in 1832, to illustrate the Voyage of Captain Graah, &c., and which also exhibits a portion of Iceland, Scoresby's Land to the N.E., and the coast to the N.W., from various authorities, up to the parallel of 73° N.
Cape Danell..............[1]	65	37	0	36	10	0	
Dannebrogs Oe or Isle......	65	18	0	38	30	0	
Cape Löwenorn (*Var.* 54° W.)	64	30	0	39	30	0	
Colberger Heide	64	8	0	40	7	0	
Cape Mosting	63	40	0	40	15	0	
Cape Juel	63	15	0	40	50	0	
Kinarbic (*Var.* 53° W.)......	62	47	0	41	42	0	
Cape Bille.................	62	1	0	41	57	0	
Cape Tordenskiold	61	24	0	42	15	0	

GREENLAND, ETC.—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Cape Discord	60 53 0	42 26 0	The CHART of GREENLAND, &c.
Cape Valloe (*Var.* 50° W.)	60 38 0	42 40 0	
Statenhuk, otherwise Cape Farewell .... [1]	59 49 12	43 53 40	
Cape Christian	59 49 30	44 5 0	
Friedrichsthal	60 0 0	44 36 0	
Nennortalik (*Var.* 51° W.)	60 7 45	45 20 0	
Julianeshaab	60 44 0	46 3 0	
Cape Thorvaldsen	60 44 0	47 56 0	
Cape Desolation	60 48 0	48 10 0	
Cape Absalon	61 3 0	48 23 0	
Frederikshaab (*Var.* 56½° W.)	62 2 0	50 2 0	
Lichtenfels	63 5 0	51 31 0	
Fiskernœs	63 8 0	51 21 0	
LABRADOR.			
Button's Isles; Middle [2]	60 35 0	65 20 0	Connaissance des Tems, &c.
Port Manvers; Entrance [3]	57 0 0	61 55 0	Captain T. Manby, R.N., 1808.
Nain, a Moravian Settlement	56 24 0	61 48 0	Inferred from Port Manvers.
Leveret Islet, at the Entrance of Netsbucktoke, or Sandwich Bay .... [4]	53 50 40	56 32 0	The Admiralty Surveys, by Lieutenant Michael Lane, &c., to 1790.
Wolf Island; North End	53 45 0	55 37 0	
Spotted Island; N.E. End	53 30 30	55 26 30	
Round Hill Island	53 25 20	55 21 0	
Hawke Island; S.E. Point	53 4 20	55 26 0	
Cape St. Michael	52 47 0	55 27 0	
Cape St. Francis .... [5]	52 37 0	55 31 18	
Point Spear	52 32 0	55 28 18	
Belle Isle; N.E. Point	52 1 16	55 19 4	
St. Lewis' Cape; small Peninsula on S.E. Point	52 21 24	55 41 23	Captain H. W. Bayfield.
Battle Islands; S.E. Island	52 15 44	55 35 19	
Henley Island; North side	52 0 8	55 53 30	
York Point; East Extreme	51 58 1	55 55 51	
Red Bay; Harbour Island, S.E. Point	51 43 55	56 8 24	
Loup Bay; Flagstaff	51 31 35	56 1 50	
Forteau Point; S.W. Ex.	51 25 37	56 59 25	
Bradore Hills; N.W. Hill	51 35 11	57 17 6	
————; S. Hill	51 34 2	57 4 32	
————; Middle or N.E. Hill	51 34 57	57 13 50	
Greenly Island; N.E. Point	51 23 19	57 13 34	
NEWFOUNDLAND.			
Cape Norman .... [6]	51 38 5	55 55 48	The Admiralty Surveys, by Lieutenant (since Captain) Fred. Bullock, R.N., and his assistants, Messrs. T. Smith, &c., 1823, 1824, 1825, and 1826. The longitudes adjusted by the Observations of Captain H. W. Bayfield, &c.
Cape Bauld	51 38 10	55 28 18	
Griguet Bay; East Point	51 32 30	55 29 18	
White Cape, near St. Lunaire Bay	51 30 25	55 29 21	
Needles Rocks, near Braha	51 26 5	55 30 33	
Bréhat or Braha Shoal (6 *ft.*)	51 25 40	55 27 48	
Cape St. Anthony	51 21 0	55 33 3	
Cremaillière Cove; Entrance, East Point	51 18 30	55 38 18	

REMARKS.

By these excellent Surveys, a very important desideratum has been

NEWFOUNDLAND—continued.

	Lat. N. °	′	″	Lon. W. °	′	″	Authorities.
Goose Cape; S.E. Point ...	51	17	20	55	38	48	obtained; for, before they were executed, the coasts which they display were comparatively unexplored, although frequented, more or less, by the fishers.—*British American Navigator.*
How Harbour; Entrance, West Point..................	51	20	0	55	58	48	
Fishot Isles; Northern Isle	51	12	30	55	41	18	
Croque Harbour; Entrance	51	2	30	55	49	18	
Groais Isle; N.E. Point ...	50	58	30	55	34	48	
Southern Belle-Isle; N.E. Point	50	48	0	55	30	18	
Rouge Isle; North Point...	50	54	0	55	49	48	
Canada Bay; Entrance ...	50	42	30	56	9	48	
Hooping Harbour; Entrance	50	36	0	56	15	28	
Fourchet Harbour; Entrance	50	31	0	56	16	48	The Admiralty Surveys, by Lieutenant (since Captain) Fred. Bullock, R.N., and his assistants, Messrs. Thomas Smith, &c., 1823, 1824, and 1825; and the Observations of Captain H. W. Bayfield.
Orange Bay, Entrance.	50	22	0	56	28	48	
Little Harbour-Deep Head	50	14	0	56	34	48	
Cat Head; Extremity	50	7	0	55	42	18	
Coney Arm Head	49	57	30	56	47	48	
Partridge Point...............	50	9	20	56	11	18	
Fleur de Lys Harbour; East Point	50	6	40	56	10	0	
St. Barbe, or Horse Isles; S.E. Point	50	11	0	55	44	28	
Pacquet Harbour; Entrance	49	58	30	55	52	48	
La Scie Harbour; Entrance	49	58	0	54	38	48	
Promontory of St. John, North Bill	49	59	30	55	32	48	
Middle Cape...............	49	57	30	55	30	48	
South Bill	49	56	5	55	30	28	
St. John's Gull Isle	49	59	30	55	33	48	
Bishop's Rock	49	55	30	55	29	18	
Nippers' Isles; S E. Point...	49	47	0	55	53	48	
Cutwell Harbour; E. Point	49	37	0	55	41	48	
Triton Harbour; Entrance	49	33	0	55	38	48	
Fortune Harbour; N.W. Point	49	32	0	55	17	48	
Toulinguet Harbour; North Entrance	49	36	0	54	49	18	
Change Isles; N.E. Islet...	49	41	35	54	25	48	
Fogo Harbour; Eastern Entrance	49	44	20	54	11	4	
Cape Fogo; S.E. Extremity	49	39	30	54	2	48	
Ireland Rock (always breaks)	49	51	45	54	5	48	
Inspector Rock (sometimes breaks)	49	47	0	53	58	23	
Snap Rock, of 10 feet	49	54	0	53	45	8	
Funk Island; Escape or East Point.................	49	44	21	53	15	8	The Admiralty Surveyors, Messrs. George Holbrook and William Bullock, 1819 to 1826, adjusted by the Observations of Mr. J. Jones, 1828, and others.
Green Island, in Rocky Bay	49	29	0	54	14	48	
Ragged Point	49	30	0	54	1	48	
Deadman's Point	49	25	18	53	45	18	
Outer Cat Island	49	23	25	53	40	8	
Freels' Gull Island ......[7]	49	19	6	53	28	46	
Charge Rocks (6 feet)	49	18	0	53	22	58	
Stinking Islands	49	13	40	53	22	8	
Fool's Island, off the N.W. Arm	49	9	15	53	36	18	
Shoe Cove Point	49	4	40	53	37	18	

Remarks.

In former editions the longitudes of the S.E. and South coasts were

NEWFOUNDLAND—CONTINUED.

	LAT N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Offer Gooseberry Island ...	48 58 20	53 32 48	The Admiralty Surveyors, as before.
Malone's Rock	48 53 30	53 30 28	
Great Black Island, Centre of	48 50 8	53 38 3	
Little Denier Island	48 40 50	53 36 38	
Western Head	48 37 15	53 27 48	
Southern Head	48 37 15	53 21 48	
Young Harry Reef	48 48 5	53 4 3	deduced from the observations and Surveys of Captain James Cook, Lieutenant M. Lane, Messrs. Cassini, Verdun, Borda, Pingré, and Owen; and these were, generally, from 10 to 15 minutes *eastward* of those now given in the Table: but the longitude of the Burgeo Isles [*Eclipse I.*] *remains as given by Captain Cook;* and that of St. Pierre may, also, be considered as the same. A Survey of *Port St. Pierre*, by Lieutenant Du Petit Thouars, gives the Government House, N.E. of the town, in 46° 46′ 30″ N., and 56° 9′ 45″ W. The French astronomers, Messrs. Verdun, Borda, and Pingré, in the voyage of *La Flore*, 1771, gave the town of St. Pierre in 46° 46′ 30″ N., and 56° 10′ W., and thus confirmed the previous determination of the Burgeo Islands, by Captain Cook, from a solar eclipse, in August, 1766.—*Phil. Trans.*, 1767.
Bonavista Gull Island	48 42 40	53 5 8	
North Head, Catalina	48 32 28	53 1 54	
South Head, Catalina	48 27 38	53 6 40	
Horse Chops	48 21 30	53 14 18	
Entrance of Trinity Harbour	48 21 30	53 22 38	
Bonaventure Head	48 16 30	53 23 58	
Bacalieu, North Point of ...	48 9 1	52 50 34	
Cape St. Francis	47 48 4	52 49 29	
St. JOHN'S, Fort Townsend ....[8]	47 33 42	52 44 45	
Cape Spear; Lighthouse ...	47 30 53	52 39 15	
Bull Head	47 18 1	52 47 7	
Cape Broyle, North Point of	47 3 52	52 53 15	
Cape Ballard..................	46 46 46	52 59 11	
Cape RACE	46 39 44	53 4 57	
Virgin Rocks, on the great Bank of Newfoundland...	46 26 30	50 55 20	
Cape Pine; Lighthouse ...	46 37 14	53 35 50	
St. Mary's Cape	46 49 25	54 14 33	
Placentia Harbour	47 15 11	53 55 3	
Little Southern Harbour ...	47 43 32	53 54 38	
Extremity of Placentia Bay	47 49 46	53 57 14	
Bordeaux Harbour	47 45 28	52 58 30	
CAPE CHAPEAUROUGE ...	46 54 19	55 20 31	
St. PIERRE; Lighthouse...	46 46 52	56 8 44	
Cape Miquelon	47 8 11	56 19 30	
Connaigre Shoal	47 23 57	55 57 19	
Pass Island	47 29 2	56 11 13	
Cape La Hune	47 31 55	56 50 23	
Outer Penguin Island	47 22 9	56 58 7	
Eclipse Island	47 36 6	57 36 15	
CAPE RAY	47 36 56	59 20 10	Captain H. W. Bayfield, 1827 to 1834.
Cod Roy Isle; South side .	47 52 38	59 26 45	
Cape St. George	48 28 54	59 14 34	
Red Isle; S.W. Point	48 33 58	59 16 16	
South Head of the Bay of Islands	49 6 12	58 23 40	
Cow Head	49 55 12	57 51 16	
Port Saunders; Entrance, N.E. Point..................	50 38 36	57 20 57	
Point Rich; West Extremity	50 41 47	57 27 14	
Point Ferolle; Cove Point, N.E. Extremity............	51 2 22	56 5 38	
Anchor Point	51 14 30	57 45 30	
Green Islet; N.E. Extremity	51 24 18	56 36 46	
Cape Norman	51 38 5	55 56 21	

NOTES.

1. Cape Farewell.—In the maps and charts, in general, the name of Cape Farewell is attached to the southern point of the continent of Greenland. In the Dutch charts, which have been republished in London, the same name is applied to an island, at the assumed distance of 45 leagues W.N.W. from that point. Hence, one point has frequently been mistaken for, or blended with, another; and this affords, therefore, one reason for the discordant accounts of longitude, &c. Such mistakes are not likely again to occur, as will be seen by the following statement.

In the first volume of the "Journal of the Royal Geographical Society" is given an account of *Discoveries on the Eastern Coast of Greenland*, by Captain Graah, of the Danish Royal Navy, in 1829, who proceeded along the coast from Staten Hook to the parallel of 65½°, and who has disproved the existence of any ancient European colony upon it. In a single boat, amid difficulties almost insuperable, with only two Greenland men and four women, M. Graah reached an island, in latitude 65° 18′; longitude, *computed*, 38° 27′; he proceeded onward until stopped by an insurmountable barrier of ice, and was forced to return to the S.W.

All the coast appeared to be colder, more barren, and miserable, than the western coast. "It may be said to consist of one uninterrupted glacier, exhibiting only a few patches of vegetation, generally on the banks of the rivers, and elsewhere, often advancing into the sea and forming promontories of ice, which are passed with so much the more danger that they frequently fall in avalanches."

During the whole summer of 1829 there was not one day which could be called warm; and before the 14th of June the thermometer had never risen above 53°. At *Ekolumius*, in lat. 63° 30′, the vegetation appeared to be superior to that of any other part of the coast, even of *Julianeshaab*, on the S.W., reputed to be the most favoured part of that coast. But the vegetation appears to consist only in a fine grass, which withers quickly when exposed to the warmth of the sun, and in some anti-scorbutic plants, as sorrel and scurvy grass, with one or two kinds of flowers, and low bushes of willow and birch, not exceeding 2 feet in growth.

The food of the natives is principally the dried flesh of the seal, with a little game and fish. Captain Graah makes mention of bears, hares, birds, and salmon; but he says that, "even at the latitude of 63° 36′, reindeers and hares are known only by name." The people, in their moral character, he describes as very estimable; "and the reported good nature of the husbands, the submission of their wives, the obedience of the children, and the mutual affection and confidence of the whole community, make it difficult to remember that they are pagans." It was the good faith, the hospitality, the kind and generous dispositions, of these children of nature, that enabled M. Graah to overcome the difficulties by which he was surrounded.

On the 3rd of November, 1831, Captain Graah returned to Copenhagen from a second voyage along the coast of Greenland, but without having passed much to the northward of his former limit. The Geographic Society of Paris subsequently presented their gold medal to the captain, accompanied by their diploma, for his persevering and indefatigable attempts in exploring this coast.

During his last stay, Captain Graah determined the longitudes of the two southern Danish settlements, *Julianshaab* and *Nennortalic*, with great precision, by means of occultations of fixed stars, &c.; and we also gain, by his observations, the positions of *Cape Farewell*, never before ascertained, and *Cape Christian*, another promontory of the same island: Cape Farewell, lat. 59° 49′ 12″, lon. 43° 53′ 40″: Cape Christian, lat. 59° 49′ 30″, lon. 44° 5′ 0″.

The eastern coast, latterly explored, is now distinguished by the name of the late excellent *King Frederick VI*.

It may be agreeable to many of our readers to be informed, that in No. 27 of the "Nautical Magazine" is included a paper, entitled "*Arctic Expeditions from England*," which displays a summary of the whole, from the time of the Cabots, in the reign of Henry VII., to the year 1834, and is one of those documents which no Englishman can peruse without pride and gratification.

2. Labrador.—For the formation of icebergs on this coast, which are so often met with to the southward, see our "Memoir," &c., on the Northern Ocean, page 43.

3. Port Manvers, formerly called Saltpetre Haven, was visited and explored by

the *Thalia* and *Medusa* frigates, which wooded and watered here, in August, 1808. Of the mode in which the longitude was determined, we have not yet been informed. The coast, as well as that of Greenland, now appears more to the westward than it was formerly represented.

Of Port Manvers a particular plan is given on our large Chart of the Northern Ocean. Without the entrance, on the East, are two groups of small isles, and near it is a cluster of dangerous rocks. The entrance itself is less than a mile broad, but the land within opens into a fine basin, on the shores of which are wood, water, and winged game, in abundance. At about 2 leagues, *true South*, from the entrance, is *Mount Thoresby*, 2,733 feet in height.

4. Sandwich Bay.—This fine harbour was surveyed by Lieutenant Michael Lane, in 1771, but not the different entrances. The defect was, however, remedied by Lieutenant Robert Pearce, of H.M.S. *Favourite*, in 1820. A range of mountains, called *Mealy Mountains*, stand on the N.W. side of the harbour, and, being 1,482 feet in height, always covered with snow, may be seen from without Wolf Island, a distance of 17 leagues.

5. Cape St. Francis.—The coast in the vicinity of Cape St. Francis was surveyed by Mr. J. L. Roberts, of H.M.S. *Favourite*, in 1820. At half a mile W.S.W. from the cape is *St. Francis Harbour;* and at 1¼ miles north-westward from the same is *Sealing or Seal Bight.* St. Francis Harbour is snug and secure, but very small, and generally filled with vessels, during the fishing season, as a considerable fishery is carried on in its vicinity. Sealing Bight is more commodious; and here water may be conveniently had, but no wood.

6. Cape Norman.—This cape is placed by Captain Bayfield in 51° 38′ 5″ North, and 55° 56′ 21″, or 8° 21′ to the West of the former surveys. The position in the table is 33″ East of Captain Bayfield's; and the longitudes of the whole of the N.E. coast, as far as Cape Freels, have been made in accordance with this.—*See Note* 8.

7. Cape Freels.—In the valuable survey northward of Cape Freels, by Lieutenant Frederick Bullock, 1823-24, this cape is placed 4′ 10″ South of the same, as given in the survey southward, by Messrs. Holbrook and William Bullock, in 1817: to connect this with the southern parts, we have given the latter authority.

8. St. John's.—The longitudes of all the places on the eastern coast of Newfoundland are given *westward* of those assigned in the previous edition of this work, and as also repeated in the *British American Navigator*.

Although by following the former statement the mariner would be on the safe side of the error, if any; yet, as the recent surveys of Captain Bayfield, and the officers under the orders of Sir C. Ogle, &c., all tend to place these coasts in a greater longitude than those given by the surveyors themselves; and as these results have been also assumed by Lieutenant Raper, in his valuable work, which must be regarded as the general standard of hydrographic positions, it has been deemed advisable to depart from the former tables, and give those longitudes more in accordance with the later, and, perhaps, more careful determinations.

The longitude of St. John's, as deduced from the observations of Captain James Cook, Lieutenant Michael Lane, Messrs. Cassini, Verdun, Borda, Pingré, and Owen, would be generally from fifteen to ten minutes eastward of the longitude in the Table; Fort Amherst, at the entrance of the harbour, having been given in 52° 29′ W., or 13′ 45″ eastward of the later observations. In the Admiralty Chart of Trinity and Conception Bays, 1835, Fort Amherst (2′ East of Fort Townshend) is placed in 52° 37′, or 3° 45′ East of the position in the Table.

In the years 1828, 1829, and 1830, the officers of H M.S. *Hussar*, under the orders of Rear-Admiral Sir Charles Ogle, made many observations in this part of the world; and the result given by Mr. John Jones, for the longitude of Fort Townshend, is 54° 45′ 29″ W., and latitude 47° 33′ 42″, and which position is recorded in the fort itself.

As before stated, all later observations having placed St. John's and other places farther to the West, we have given the longitude 52° 44′ 45″, as stated in Lieutenant Raper's tables, which will be found in accordance with them. Therefore the longitudes of the eastern portion of Newfoundland have been altered by having 5′ 48″ added to them.

NEWFOUNDLAND.—The description of the coasts and harbours of this island, with

ample directions for the navigation, &c., will be found in the "*British American Navigator*," 1843, published by Mr. Laurie.

VARIATIONS OF THE COMPASS.—The variation on the eastern coast of South Greenland, as found by Captain Graah, is shown in the Table. More to the West, in lat. 59° 42′, lon. 48°, it was found to be 42¼° W. in 1819. The variation, as found by Captain Ross, in 1818, in the middle of the entrance of Baffin's Strait, was 48°. At Port Manvers, on the coast of Labrador, Captain Manby found it to be 41¼° in 1808. In Sandwich Bay it was 40° in 1820. It decreases thence to the southward. Off Cape Charles, the Admiralty Surveyors have lately given it as 34°; off Cape Bauld, 31° 54′; at St. Lunaire Bay, 32°; Cape Rouge to La Scie, 31¼°; Change Isles, 29°; Fogo Island and Cape Freels, and St. John's, 28°; Placentia Bay, 27°; St. Pierre, 27°; Cape Ray, 24°; Cow Head, 29°; but we apprehend that this is rather *more* than the true variation at the present time, *if we may judge from former results;* all of which represent it as several degrees less; but the surveyors say that the variations near the coast, in several places, appear to be greater than those at sea; which is attributed to local magnetic attraction.

THE PHAROLOGY OF NEWFOUNDLAND.

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus	Height above High Water.	Visible in Miles.	Year erected.
CAPE BONAVISTA. One revolving light every 2 minutes, *red* and bright alternately.	A square tower, 36 feet high, on the extremity of the cape.	●	150	20	1843
HARBOUR GRACE. One bright fixed light.	A square wooden house, surmounted by a tower on an islet at the entrance. Visible from N.N.E. to S.S.W., to seaward	●	148	20	1836
ST. JOHN'S. One bright fixed light.	On Fort Amherst, on the S. head.	●			1834
CAPE SPEAR. One bright revolving light every minute.	A square red and white tower, 30 feet high, on the cape.	●	275	25	1836
CAPE PINE. One brilliant revolving light every 20 seconds.	A circular iron tower, 56 feet high, painted with red and white bands.	●	302	22	1850
ST. PIERRE ISLAND. One bright fixed light.	A tower, 36 feet high, on Gallantry Head	●	210	18	
ST. PIERRE HARBOUR. One fixed light.	On Canon Point, N. side of the entrance; from May 1 to December 15.			3	

11. GULF AND RIVER OF ST. LAWRENCE, WITH BRETON ISLAND.

POSITIONS OF PLACES.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
THE GULF. [1]			
ISLAND OF ST. PAUL. [2]			The Observations of Captain Henry Wolsey Bayfield, F.R.A.S., of H.M. surveying vessel, *Gulnare*, 1827 to 1834.
Northern Extremity	47 14 0	60 11 17	
Eastern side of Neck............	47 13 14	60 11 28	

GULF AND RIVER OF ST. LAWRENCE, ETC.—CONTINUED.

	LAT. N.			LON. W.			AUTHORITIES.
	°	′	″	°	′	″	
MAGDALEN ISLANDS. [3]							
ntry Isle; East Point.........	47	17	0	61	43	30	The Observations of Captain Henry Wolsey Bayfield, F.R.A.S., of H.M. surveying vessel *Gulnare*, 1827 to 1834.
eadman Islet; West Point	47	16	8	62	15	20	
mherst Harbour; Entrance	47	34	28	61	52	21	
offin's Island; N.E. Point...	47	17	30	61	26	0	
orthern Bird Islet	47	51	2	61	12	11	
Brion or Cross Isle; East Point	47	47	58	61	27	33	
ANTICOSTI. [4]							
East Point........................	49	8	45	61	42	59	
South Point	49	3	43	62	18	30	
S.W. Point; Lighthouse	49	23	53	63	38	47	
Cape Henry; S.E. Extremity	49	47	50	64	25	44	
West Point; Extremity	49	52	20	64	35	8	
North Point	49	57	40	63	12	0	
Observation Cape	49	38	59	62	44	24	
Bear Bay; Entrance of the River	49	30	30	62	27	29	
LABRADOR, &c. [5]							
Bradore Harbour; Flagstaff	51	27	38	57	17	6	
Mistanoque Isle, near Shecatica	51	15	51	58	15	7	
Mecatina Grand Point; S.E. Extremity	50	44	10	59	2	55	
Hare Harbour; East Side ...	50	36	32	59	20	7	
Wapitagun Harbour; Islet on South Side.....................	50	11	48	60	4	5	
Cape Whittle; S.W. Isle near	50	10	44	60	9	46	
Kegashka Bay; Islet on South Side	50	11	27	61	18	21	
Natashquan River; South Point	50	7	5	61	50	43	
Nabesippi River; Point on S.E.	50	14	0	62	15	49	
MINGAN HARBOUR; Agency House..........................	50	17	20	64	4	50	
St. John's River; South Point	50	17	10	64	23	16	
Point St. Charles; Extremity	50	15	25	65	51	50	
River Moisic; Entrance	50	11	24	66	7	41	
Carousal Isle; South Extremity	50	5	29	66	26	35	
Bay of Seven Islands; the Store	50	13	7	66	27	7	
Point St. Margaret; Extremity	50	2	33	66	47	45	
Cawie Isles; Little Isle	49	49	29	67	4	57	
Egg Isle..........................	49	38	21	67	3	10	
Trinity Cove; S.W. Point ...	49	23	47	67	21	12	
POINT DE MONTS; Lighthouse	49	19	43	67	25	2	
————; Southern Extremity ....[6]	49	18	49	67	26	22	
THE RIVER OF ST. LAWRENCE. [6]							
Cape Chat; Extremity	49	6	0	66	48	19	
River Matane; Entrance......	48	51	43	67	34	29	
St. Nicolas Harbour; West Point	49	18	34	67	49	42	
Manicouagan Point; S.E. Extremity	49	6	13	68	15	0	
Bersimites River; Entrance	48	55	31	68	40	30	

REMARKS.

The times of high water in the River of St. Lawrence, with some general observations on the tides, are attached to the Tide Table, given hereafter; but it is particularly to be noticed, as shown by Captain Bayfield, that around "*Point de Monts* there is little or no stream of flood, excepting very close in-shore: the downward current being constant, or very nearly so, off that point; and it requires a fast-sailing vessel to beat round it against a westerly wind. Point de Monts turns this current over to the S.S.E., at a rate varying from 1 to 2 knots: so that a vessel, having a West wind, and standing over to the southward on the starboard tack, will be carried toward the South coast at a rapid rate, having the current on her weather quarter; and, during her board back to the northward, she will be retarded, the stream or current being then directly opposed to her course. When sailing at the rate of 4 knots,

GULF AND RIVER OF ST. LAWRENCE, ETC.—CONTINUED.

	LAT. N.			LON. W.			AUTHORITIES.
	°	'	"	°	'	"	
Jeremie Isles; Hudson's Bay Post	48	52	53	68	49	52	it will usually require only about half the time to go from near Point de Monts, over to the South coast, that it will take to return from the latter to the former. This circumstance it is necessary to carefully guard against, when beating up the estuary during dark nights, and especially in foggy weather."
Port Neuf; Church	48	37	25	69	9	0	
Little Metis; Reef	48	41	18	68	4	39	
Mount Camille; Summit (7 miles inland: 2,036 feet) ...	48	28	44	68	15	55	
Father Point, Pilots' Houses[6]	48	33	30	68	30	40	
Barnaby Isle; N.E. Point ...	48	29	43	68	35	2	
Bic Isle; S.E. Reef............	48	25	17	68	51	30	
Tadousac, on Saguenay River	48	8	40	69	46	1	
Green Island; Lighthouse ...	48	3	25	69	29	14	
Brandy Pots; S.E. Point......	47	52	35	69	43	47	
Kamouraska; N.E. Point of Crow Island	47	35	17	69	55	48	
Isle aux Coudres; N.W. end	47	24	48	70	28	30	
Crane Island; South End ...	47	2	30	70	38	10	
QUEBEC; Citadel ......[6]	46	48	49	71	16	0	
Montreal; Cathedral	45	30	34	68	54	47	
NEW BRUNSWICK, &c.							The Observations of Captain Bayfield, of H.M. surveying vessel *Gulnare*, 1827 to 1849.
Mount Louis River; Entrance	49	14	35	65	46	20	
Cape Magdalen	49	15	45	65	22	0	
Cape Rosier ....[7]	48	52	19	64	14	49	
Cape Gaspé; Flower Pot Rock ....[7]	48	45	10	64	12	22	
Douglas; the Town, South side	48	46	20	64	24	42	
Bonaventura Isle; N.W. Point	48	30	0	64	11	12	
Cape Despair....................	48	25	30	64	21	30	
Point Paspebiac; South Ex.	48	0	50	65	17	20	
Point Miscou....................	48	1	45	64	33	50	
Point Escuminac; Beacon ...	47	4	37	64	50	36	
Richibucto; North Beacon, Entrance ....[8]	46	43	9	64	50	55	
Cape Tormentin Rocky Point	46	7	0	63	49	15	
Pictou Isle ....[9]	45	47	52	62	33	25	
Pictou Harbour; Lighthouse	45	41	30	62	32	26	
Cape George	45	52	15	61	56	20	
Gut of Canso; Lighthouse at North end	45	42	0	61	32	0	
PRINCE EDWARD ISLAND.							
East Point ....[10]	46	27	50	62	1	30	Captain H. W. Bayfield. 1843 to 1849.
North Cape	47	3	50	64	2	26	
Cape Traverse	46	13	22	63	32	0	
CHARLOTTE TOWN; Church	46	14	0	63	10	16	
Bear Cape	46	1	15	62	30	0	
BRETON ISLAND, &c. [11]							
Cape North	47	2	0	60	26	20	Captain Bayfield.
Niganish Bay; Middle Head	46	39	40	60	24	0	
St. Anne's Bay; Siboux Isles, N.E. Shoal	46	24	20	60	25	0	
Sydney Harbour; Lighthouse on Flat Point.......	46	18	15	60	8	30	Mean of the Positions assigned.
Town of Sydney, Barracks ...	46	9	0	60	15	30	

GULF AND RIVER OF ST. LAWRENCE, ETC.—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Scatari Isle; *Lighthouse* on the N.E. Point	46 1 30	59 40 0	Mean of the Positions assigned by Messrs. Wright, &c.
Louisbourg; Lighthouse	45 54 30	59 55 30	Messrs. Chabert & Des Barres.
Albion Cliff, on the South side of Isle Madame ....[12]	45 28 12	61 2 0	M. Des Barres, subsequently corrected.
Eddy Point; Entrance of the Gut of Canso..................	45 30 30	61 15 20	
Bear Head; the Islet	45 32 20	61 17 30	
Ship Harbour, in the Gut of Canso	45 36 24	61 21 25	

NOTES.

1. GULF OF ST. LAWRENCE.—Among the difficulties of the navigation in the Gulf of St. Lawrence are the fogs and ices. In spring the entrance and eastern parts of the gulf are frequently covered with ice, and vessels are sometimes beset for many days. Being unfitted for contending with this danger, they often suffer from it, and are occasionally lost; but all danger from ice is far less than that which arises from the prevalence of fogs; these may occur at any time during the open or navigable season, but are most frequent in the early part of summer; they are rare, and never of long continuance, during westerly winds, but seldom fail to accompany an easterly wind of any strength or duration. This observation is, however, subject to restriction, according to locality or season. Thus winds between the South and West, which are usually clear weather winds above Anticosti, are frequently accompanied with fog in the eastern parts of the gulf. Winds between the South and East are almost always accompanied with rain and fog in every part. E.N.E. winds above Cape de Monts, at the mouth of the river, are often E.S.E. or S.E. winds in the gulf, being changed in direction by the high lands of the South coast, and have, therefore, in general, the same foggy character. This is said of winds of considerable strength and duration, and which may extend over great distances. Moderate and partial fine weather winds may occur without fog at any season, and in any locality. In the early part of the navigable season, especially in the months of April and May, with clear weather, N.E. winds are of frequent occurrence, and they sometimes occur at other seasons, in every part of the gulf and river.

The fogs sometimes last several days in succession, and to a vessel either running up or beating down, during their continuance, there is no safe guide but the constant use of the deep-sea lead, with a chart containing correct soundings.

The fogs which accompany easterly gales extend high up into the atmosphere, and cannot be looked over from any part of the rigging of a ship. They, however, are not so thick as those which occur in calms after a strong wind, and which are often so dense as to conceal a vessel within hail; whilst the former frequently admit the land or other objects to be distinguished at the distance of half a mile, or more, in the day time.

The dense fogs which occur in calms, and even in very light winds, often extend only to small elevations above the sea; so that it sometimes happens, when objects are hidden at the distance of fifty yards from the deck, they can be plainly seen by a person 50 or 60 feet up the rigging. In the months of October and November, the fogs and rain that accompany easterly gales, are replaced by thick snow, which causes equal embarrassment to the navigator.—*Captain Bayfield.*

2. The ISLAND of ST. PAUL lies N. 52° E., *true*, 10 miles from Cape North; it is about 1½ miles in length from North to South, and inclining to the eastward at the North end. Its average breadth is about a quarter of a mile. The margin is rocky and precipitous almost all round, indented on the N.E. and N.W. sides by two coves, in both of which boats may obtain shelter during the prevalence of certain winds. The cove on the N.W. affords a small and bold beach, about 150 feet long, where a landing may be effected, but generally with difficulty, by reason of the continual swell of the

sea. The interior of the island rises into three hills, the highest being nearly in the centre, and terminating in a square summit of about 50 feet on each side, and nearly perpendicular, which is estimated to be about 258 feet above the level of the sea. The surface of the island is, in general, rocky, with some spots of marsh or bog, which probably supply the fresh water found issuing from the rock. Stunted fir and white birch trees are the only products of the isle, but some drift wood may be picked up. It is not known what animals, if any, inhabit this spot.

There is good anchorage all round the island, and close in-shore, which circumstance enables vessels to lie there with any winds, by shifting their stations as the wind and weather require. The current runs generally about 4 miles an hour, and nearly S.S.E.

St. Paul's has been noted for the great number of wrecks which have been found on its shores, arising from the frequent fogs and tempestuous weather, the uncertain currents, and abrupt nature of its coast, &c.; but on this island are now two lighthouses, one near its northern and the other near its southern extremity; of which one will always be open, unless to a vessel near the central rocks. The northern light, brilliant and fixed, is about 130 feet above the level of the sea; it can be seen to the southward on any bearing excepting between N. by E. and E. by N., when it is obscured by the hills to the southward of it. The southern light may be seen from the northward on any bearing except between S.S.E. and West, when it is obscured by the hills to the northward of it. Range of light, from each tower, 6 leagues. Boats to render assistance, and guns for signals.

3. The MAGDALEN ISLANDS.—These islands have been surveyed by *Lieutenant P. E. Collins*, in 1833, and a beautiful chart of them has been published by the Admiralty. They form an irregular group, and are named, respectively, *Entry Island*, *Amherst*, *Grindstone*, *Alright*, *Wolfe*, *Grosse*, and *Coffin Islands;* exclusive of *Byron* or *Cross Island*, and the *Bird Islets*, which lie more to the North. Of these, *Amherst* is the most southern and principal island, but *Entry Island* is the highest, and is 580 feet above the sea; visible from 8 to 9 leagues off.

They are annexed to the district and county of Gaspé, and contain a population of nearly 1,000 souls, chiefly French Acadians and Catholics. Eleven English and five Irish families are settled among them, all of whom derive their principal subsistence from the fisheries. Beyond the cultivation of potato gardens, agriculture seems wholly unknown on the islands: but natural meadows and pasturing grounds are common, and afford wholesome sustenance to a tolerable proportion of live stock. The inhabitants are, in general, remarkably hale and healthy, light in complexion, with flaxen hair. They are cheerful in character, and the females remarkably modest and ingenuous. The highest range of Fahrenheit's thermometer has been marked at 76°. It has been also observed that the islands are devoid of reptiles of any description; and that beside the fox, rabbits are to be found. There are two churches on the islands, and a parsonage house for the resident missionary.—(*Bouchette*, vol. i. p. 332.)

It often happens, from the prevalence of westerly gales in the fall of the year, that ships bound to Quebec, after entering the gulf, have been driven out again, or they have contended until their crews were worn out, and have gone to the low ports for cargoes, when, by taking an anchorage, they would have secured their passage. These islands may be approached, generally, by the lead, to 7 fathoms of water.

Byron or *Cross Island*.—The North side has steep cliffs of red sandstone, from which reefs extend 2 or 3 miles. Approach no nearer than in 8 fathoms. On the South side there is good shelter, with North and West winds, in 6 fathoms, sandy bottom, the East end of the island bearing E. by S., and the reef to the westward bearing West. In this road is a strong underset, which makes a ship, at her anchors, roll heavily.

These islands are fully described in the *British American Navigator*, pp. 87—89.

4. ANTICOSTI.—This island, with one exception, has no bay or harbour capable of affording shelter to shipping in general: it is uncultivated; yet, rude and unhospitable as its aspect may be, it is not absolutely unprovided with the means of succouring the distress of such as suffer shipwreck on its coasts, there being government agents who reside upon it, at different stations, all the year, furnished with provisions for the use of those who have the misfortune to need them. Boards are placed in different parts, describing the distance and direction to these friendly spots: these establishments were first made in the year 1809.

"One of these provision posts is at 2 leagues to the S.E. from the West end of the island, in Ellis's Cove, or Grand Bay; the second at the lighthouse at the S.W. point; the third at Shallop Creek, otherwise called Jupiter River; and the fourth at the eastern lighthouse on Heath Point."

The South shore of the island is dangerous; but to modify its character *four* beacons have been erected—1. With a small triangular head, 40 feet high, on the South point. 2. At Pavillon River, large triangle, with cross over. 3. Six miles East of Salt Lake Bay, large triangular head. 4. On Cape St. Mary, with a cross (1851).

Ellis Cove or *Grand Bay*, when known, may become of general use to ships bound to Quebec. It is on the South side, about 3 miles from the West end of the island. To enter, you haul round the reef of Cape Henry in 5 fathoms, and keep a white cliff between two mountains; run in with this mark until you shoalen the water to 4 fathoms. Then steer for the houses on the North side of the bay, and anchor in 3½ fathoms. The ground is here good, sheltered from all winds, excepting from S. by W. to S.W.

5. LABRADOR.—The Description and Directions by Captain Bayfield, of this hitherto but little-known region, are given in the *British American Navigator*, p. 91, &c.

6. QUEBEC, &c.—"The latitude of Quebec is 46° 47′ 30″, according to the observations of M. le Marquis de Lotbinière, M. Bédard, Director of the Seminary of St. Louis, and Captain Holland. M. Mechain computed the longitude to be 71° 10′, by several eclipses of Jupiter's first satellite, observed by Messrs Lotbinière and Holland; and the passage of Venus that Captain Holland observed in 1769. All these observations, made at different times, have given very coherent results."—Vide *American Trans.*, vol. i., &c.

The above passage, from "Analysis of a General Chart," &c., Paris, 1786, shows the position in which Quebec has been hitherto laid down on the Charts; and it agrees with that given in the *Conn. des Tems*. But Quebec has been since exhibited considerably more to the eastward. Mr. Smyth, in his map of Upper Canada, has it in 69° 52′; the error is here enormous. Mr. Wright, in his Chart of 1807, 70° 27′. The Requisite Tables, of 1802, give latitude 46° 48′ 38″, longitude 71° 5′ 29″. Colonel Bouchette, in his work on Canada, 1815, gives 46° 48′ 49″ N., and 71° 11′ W. In the years 1819, 1820, and 1821, the officers of H.M.S. *Newcastle*, provided with four chronometers, made many observations in the river; and these observations may be judged of by the longitude they placed Quebec in for three successive years, assuming Halifax as in 63° 33′ 40″; July 16th, 1819, 71° 12′ 48″; June 19th, 1820, 71° 13′ 14″; July 5th, 1821, 71° 12′ 25″. The greatest difference is 49″, and the mean of the whole is 1″ farther West than the longitude given in 1819.

But, if Halifax is in 63° 37′ 26″, according to Lieutenant Raper, by this measurement Quebec would be in 71° 16′ 32″, or 32″ West of Captain Bayfield's position: this difference is trifling, and we may therefore consider that this meridional distance is well ascertained. In the former editions it was considered by Mr. Purdy that this assumption of Halifax was 4′ too far to the West; and although the discrepancy may not amount to as much as this, still the recent determination by Captain W. Fitzwilliam Owen, of the longitude of Halifax as 63° 35′ 28″, or 2′ less than Lieutenant Raper, will in some measure confirm the supposition that the latter is in excess of the true longitude.

Cape de Monts, or *Point de Monts*, is on the North side of the River St. Lawrence, nearly opposite to Cape Chat: on it is a tower, with a fixed light, at about 100 feet; lying S. 52° W. from the outer part of Caribou Point, over which, and eastward of it, the light may be seen.

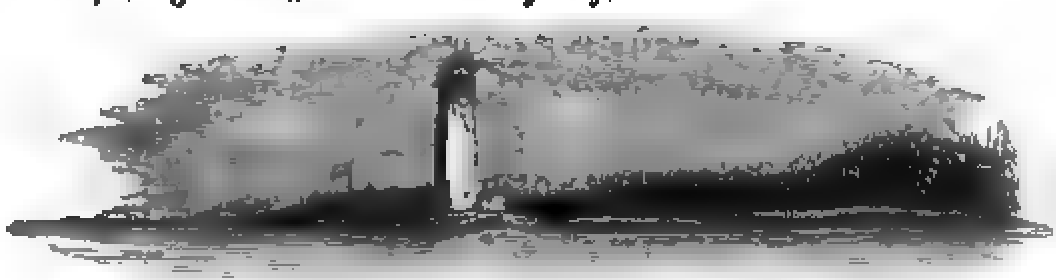
Ships from the eastward, approaching the lighthouse, on drawing toward Caribou Point, may bring it to bear W. by S., when they will be in a good fairway, and may, if requisite, advance toward land by the lead. But, after passing Caribou Point, on drawing toward the lighthouse, they should come no nearer than in 12 fathoms; for thus they will avoid two ledges of rocks, one of which lies E.S.E. from the lighthouse, with only 12 feet over it; the other lies S.W. from the lighthouse, and E.S.E. from the western extremity of Point de Monts, with 16 feet over it. These rocks are not more than half a mile from shore at low water.

From the lighthouse the western extremity of Point de Monts bears S. 64° W., about 1 mile; and, when a ship is to the westward of the point, the lighthouse will appear in one with the outermost rocks off the same. In the day time it forms a bold distinct landmark, and from this line of bearing ships are in the best fairway for proceeding up or down the river. You may, if it be required, safely approach the North shore until the lighthouse bears E. by N.;

but when it bears E. ½ N. it will be time to tack. When bearing East it will shut in with the high land, and cannot be seen to the southward of East, at only a mile from the land.

From off St. Nicholas Harbour, with the light bearing E. by N., the S.E. spit of Manicougan Great Shoal, the ship, and the lighthouse, will be all in one line of bearing.

Captain Bayfield says, "In making the light on Point de Monts, remember that it is not on the extremity of the point, but has been placed (as I think very improperly) 1½ miles to the north-eastward, along the coast toward Trinity Bay."



Lighthouse on Point de Monts, West, 1 mile.

QUEBEC, &c.—The situation of Quebec, the capital of Lower Canada, and the residence of the Governor-General of British North America, is unusually grand and majestic, in form of an amphitheatre. The city is seated on the N.W. side of the St. Lawrence, upon a promontory, formed by that river and the St. Charles. The extremity of this headland is called *Cape Diamond*, of which the highest point rises 345 feet above the level of the water. It is composed of a rock of gray granite, mixed with quartz crystals (from which it obtains its name) and a species of dark-coloured slate. In many places it is quite perpendicular and bare; in others, where the acclivity is less abrupt, there are patches of brownish earth, or rather a decomposition of the softer parts of the stone, on which a few stunted pines and creeping shrubs are here and there seen; but the general aspect of it is rugged and barren.—(*Bouchette*, vol. i. p. 241.)

Population in 1759, about 9,000; now about 28,000.

(For Sailing Directions, see our *British American Navigator*.)

7. Gaspé Bay has been described as the best harbour in the Gulf of St. Lawrence; the only danger to be avoided being a spit of sand on the South shore, which forms the basin. It is steep-to on the East, and there can be no trusting to the lead. With a leading wind, keep the North shore on board.

There are fishing establishments at *St. Peter's*, *Mal Bay*, and *Percée*, but the most important is at *Paspebiac*, on the northern side of Chaleur Bay. Here Robins and Co. have extensive stores; they build ships of considerable burden, and send them, loaded with fish, to all parts of the world, and particularly to Brasil and Naples. The fishery is entirely carried on in small boats, with two men in each, who return on shore every evening, when the fish is landed and cured. At the close of the summer fishing season (from the 8th to the 15th of August) all the fish caught at the several establishments, and along the coast, is brought in, and laden on board the different ships.—(*Captain R. Fair, R.N., Naut. Mag., June*, 1839.)

Mal Bay, to the southward of Gaspé, is about 4 miles across, clean sandy bottom, good riding in 10 fathoms, with the wind off-shore. Should a ship be caught here with wind from the eastward, she could either run up off Gaspé Bay (if not able to clear the land), or run between Bonaventure and Percée Islets towards Chaleur Bay; only taking care to avoid the Leander Rock, which lies off Cape d'Espoir, as described in the *British American Navigator*.

Griffin's Cove and Fox River, to the N.W. of Cape Rosier, afford shelter for small vessels with a West wind, but they lie open to the North. The shore from Cape Gaspé to Cape Rosier is very steep, with high perpendicular cliffs. Should a ship run ashore here, in an easterly gale, there would be but little chance of saving lives.

8. Richibucto.—The depth of water at the entrance of the harbour, in 1828, was, at the best tide, 18 feet, and at the common tide 16½ feet. When off the harbour, in 6 or 8 fathoms of water, vessels run in by keeping two large beacons in a line, until near the sand-hill, and then run N.W. along the shore, in 2½ to 3 fathoms of water, until they are in safety. A large buoy is laid down in 5 fathoms, outside the bar, for a guide; which buoy, from seaward, can be seen at more than a league off.

9. PICTOU HARBOUR is the principal port of the North coast of Nova Scotia. It has a bar at its mouth, on which there is a depth of 22 feet at low water. Inside the

bar it becomes a capacious and beautiful basin, with 5, 6, and 9 fathoms, muddy bottom. The town is situated at about 3 miles from the entrance, and many houses are built of stone. It contains an Episcopal, a Roman Catholic, and two Presbyterian chapels. There are, also, the academy, grammar school, court house, and a public library. The population, in 1828, was nearly 1,500 souls, and it has since very rapidly increased: it cannot now be less than between 2,500 and 3,000. Pictou has been declared a *free warehousing port;* and its trade is very considerable in lumber, coal, and the fishery. Coasters from all parts of the Gulf of St. Lawrence resort to Pictou, and its exports have amounted to £100,000 in a single year. One hundred vessels have been loaded here with timber for Great Britain, and its exports to the West Indies were not less extensive and important. —(*Bouchette*, vol. ii. p. 19.)

Latterly the timber trade of Pictou has fallen off; but the working of the coal-mines, in the immediate neighbourhood, has opened a very brisk trade in that article, which occupies some hundreds of vessels, of all dimensions, in the coasting and foreign trade, many of which carry from 500 to 700 tons, chiefly trading to the United States. The town of *New Glasgow*, in the neighbourhood of the mines, promises to be of considerable importance. There is no fishing carried on here. The country around is agricultural: and there is a quick intercourse, by steam, with Prince Edward Island.

The passage into the harbour has been much facilitated by a new lighthouse, painted vertically red and white, and showing a fixed light, as noticed hereafter. The roadstead is excellent; bottom of clay and mud.

10. PRINCE EDWARD ISLAND.—Of this island a copious description may be found in our *British American Navigator*, *&c.* It has since been noticed that, although surrounded by Canada, Nova Scotia, Newfoundland, &c., the climate of this island is, by many degrees, more mild and favourable than that of either of those colonies. The winter is two months shorter in duration, and the frosts much less severe, with a considerably less fall of snow. Fevers, and other diseases of the United States, are unknown here. The population of the island, according to the census of 1827, was 36,000; it is now estimated at 50,000.

11. BRETON ISLAND.—(*Bouchette*, vol. ii. p. 76.) SYDNEY is the shire town and capital of Breton Island. It is situated on the eastern coast of the harbour, and is a free port. The courts of justice and public offices are kept here; and here, also, the principal officers of the island reside. It contains about sixty houses, beside a government house, stores, and barracks; likewise Episcopal, Roman Catholic, and Dissenting churches. The streets are regularly laid out, the houses tolerably good, and the grounds in the vicinity cultivated with some taste; so that, on the whole, it presents a pleasing appearance. The population exceeds 500.

The harbour is one of the most capacious and secure in the provinces: it is 2 miles wide at its entrance; 4 miles above which it diverges into two extensive arms, upon one of which, about 7 miles from the sea, the town is built, on a peninsula, affording abundant suitable situations for wharfs, dockyards, &c. The surrounding country is one of the finest agricultural tracts in the island: the advantages for carrying on the fishery are excellent. The principal coal works are carried on in the neighbourhood, where useful timber abounds.

The climate of Breton Island is very similar to that of Nova Scotia, and is considered by the inhabitants to be quite as conducive to health, and favourable to agricultural pursuits, as that of any of the British American provinces; but it is allowed that it is somewhat colder in winter and hotter in summer, more irregular, and, therefore, less pleasant, than the neighbouring peninsula. The natural productions are, in all respects, similar to those of Nova Scotia. The amount of population is about 20,000.

By a recent statute of the government of Cape Breton, all ships wrecked on the coast are to be taken possession of by the collector of the customs, or any person appointed by the governor, and the proceeds made available for the maintenance of the passengers, and their transport to their original destination—a prolific source of litigation.—(*Naut. Mag.*, *August*, 1844.)

Too much caution cannot be exercised when approaching this island from any direction. The currents set alternately about Cape North according to the winds at sea, both from the westward and eastward, and their effects about the Isle of St. Paul have already been noticed. It is, however, presumed that the new lighthouses will obviate much difficulty and danger in the vicinity.

12. ARACHAT, in the Isle of Madame, has been, for many years past, the seat and centre of the fishing establishments of the Jersey merchants, who export their produce hence to the West Indies, the Mediterranean, and Brasil. It is a fine harbour, accessible at all times. The town is situate on the harbour, and is fast increasing in size, appearance, and population.—(*Bouchette*, vol. ii. p. 79.) This place was constituted a free and warehousing port, by order, August 13, 1839.

VARIATIONS OF THE COMPASS.—It has been proved, by numerous observations made by the American surveyors, Messrs. Jos. and B. Ellicott, that the westerly variation, in 1800, ceased at or very near the River Niagara, on the South side of Lake Ontario, or lon. 79° W.—(See the particular plan of the Frontier of Niagara, given on the New Map of Canada, &c., published by Mr. Laurie.) The variation at Montreal was 7° 45′ W. in 1834. In and about the same year, the variations were as follow:—At Contrecour, 8° 45′: Lake St. Peter, 10°: Trois Rivières, 11°: Quebec and Isle of Orleans, 15°: Isle Aux Coudres, 16: at Tadousac, on the mouth of the Saguenay, 17°: off the Isle Bic, 18° 40′: Port Neuf, 18° 20′: at Father Point, 19° 45′: Point de Monts, 22°: Seven Isles, 20° 27′: West end of Anticosti, 24° 30′: East end, 25° 30′: Mingan Island, 26°: off Kegashga, 27° 45′: Little Mecatina, 30° 30′: Bradore Harbour (Strait of Belle Isle), 34° 15′: Red Bay, 35° 30′.

At the Magdalen Isles it was 23° in 1833. Isle of St. Paul, 23° 45′: near Cape Ray, Newfoundland, 24°: East Point of Prince Edward Island, 21°: Pictou Harbour, 19°. In Sydney River (Breton I.), and at Cape Breton, 22°.

Mr. Bain, in his "*Essay on the Variation of the Compass*," has noticed a frequent and remarkable aberration which has been found on approaching the vicinity of Cape Chat. He says, "In the River of St. Lawrence, the change in the variation should be most particularly attended to, as it leads a ship, both in going up and coming down, on the coast most to be avoided." Mr. B. has shown that, in coming down, in May, 1813, he found it necessary to steer a different course from the opposite one followed in going up, under very similar circumstances, a few days before. The difference exceeded a point. Both in going up and down, there was a breeze of 8 and 9 knots, weather uncommonly fine, and every circumstance extremely favourable for remarks.

Subsequent to the above period, the *Zealous*, ship of war, had a very narrow escape in going up the river, the compasses in the binnacle being so much affected by local attractions, that, had the fog not cleared away at the moment it did, the ship must have run on shore, not far from Cape Chat, she being in 19 fathoms.—(See, further, the *British American Navigator*, &c., published in 1847.)

THE PHAROLOGY OF ST. LAWRENCE, WITH BRETON ISLAND.

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
SCATARI ISLAND. One bright revolving light every 2 minutes.	An octagonal white wooden tower, 60 feet high, on the N.E. point.	●	75	15	1839
LOUISBOURG HARBOUR. One bright fixed light.	A square building, 35 feet high, white, with black vertical stripes on the S.E. of entrance.		120	16	1842
MADAME ISLAND. Fixed light (building).	A square white building, on the S.W. part.				1851
SYDNEY HARBOUR. One bright fixed light.	An octagonal tower, with vertical red and white stripes, 51 feet high, on Flat Point, E. side of Spanish Bay.	●	70	14	1832
ST. PAUL'S ISLAND. 1. One brilliant fixed light.	1. An octagonal white wooden tower, 40 feet high, on a rock off the N. point of the island.	1 b	140	20	1839

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
ST. PAUL'S ISLAND. 2. One brilliant revolving light every minute.	2. A similar tower, on the S.W. point. A bell during fogs, and a gun fired every four hours, commencing at four.	1b	140	20	1830
GUT OF CANSO. One bright fixed light.	A square white wood tower, 35 feet high, on the W. side of the N. entrance, 120 yards in-shore.	●	115	18	1842
PICTOU HARBOUR. One bright fixed light.	An octagonal tower, 55 feet high, red and white vertical, on the S. point of entrance, when the navigation is free from ice.	●	65	11	1834
HILLSBOROUGH BAY (Prince Edward Island). One bright fixed light.	A white wood tower, 50 feet high, on Prim Point.		68	13	1845
MIRAMICHI BAY. One bright fixed light.	A white wood tower, 58 feet high, on Escuminac Point.		70	14	1841
ANTICOSTI ISLAND. 1. One bright fixed light.	1. A gray stone tower, 75 feet high, on Heath Point, the E. end of the island, from April to December.	●	100	15	1835
2. One bright revolving light every minute.	2. A similar tower, on the S.W. point, seen from N.N.W. to S.E. by E.	●	100	15	1831
POINT DE MONTS. One bright fixed light.	A gray stone tower, 75 feet high, 1½ miles N.E. of the point.	●	100	15	1830
BICQUETTE ISLAND. One bright revolving light every 2 minutes.	A light-tower, 65 ft. high, on the W. end. A nine pounder gun fired every hour in fogs and snow storms, from April 15 to Dec. 15.	●	112	17	1844
RED ISLAND BANK. One *red* fixed light.	A red tower, 51 feet high, on the island.	●	75	12	1848
GREEN ISLAND. One bright fixed light.	A white square stone tower, 40 feet high, on the N. point. April 15 to December 10.	●	60	13	1809
SOUTH TRAVERSE LT.-VES. One bright fixed light.	On the N.E. part of the St. Roque Bank.	●		■	1830
STONE PILLAR ISLAND. One bright revolving light every 1½ minutes.	A white stone tower, 38 feet high, near the S. point, from April 15 to December 15.	●	68	13	1843

12. NOVA SCOTIA, ETC.—(SOUTHERN COASTS.)

POSITIONS OF PLACES.

	LAT. N. °	′	″	LON. W. °	′	″	AUTHORITIES.
SABLE ISLAND: [1]							
The N.E. End	43	59	0	59	47	0	For particulars see the *British American Navigator*, 1847, pp. 165—170.
The Southernmost Part......	43	56	0	60	0	0	
The West End	43	57	0	60	15	0	
The MAIN LAND: [2]							
Crow Harbour, in Chedabucto Bay (*Rook Isle*) ...	45	20	45	61	18	8	The OBSERVATIONS and SURVEYS of Jos. F. W. Des Barres, Esq., made pursuant to the Orders of the Admiralty of Great Britain, 1775, with subsequent emendations.
Fox Is., in Chedabucto Bay	45	22	0	61	7	48	
Cranberry Island; Lighthouse	45	19	20	60	59	18	
Cape Canso, or Canseau ...	45	18	10	61	0	8	
Canso Harbour: [3]							
Northern Entrance	45	21	0	61	3	0	
Southern Entrance	45	20	0	61	0	18	
Point Gell, near Raspberry Harbour ....[4]	45	13	30	61	6	31	
Whitehead Island, off Whitehaven	45	10	15	61	11	8	

NOVA SCOTIA, ETC. (Southern Coasts)—continued.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Berry Head, on the West side of Torbay	45 10 57	61 22 0	The Observations and Surveys of Jos. F. W. Des Barres, Esq., made pursuant to the Orders of the Admiralty of Great Britain, 1775, with subsequent emendations.
Green Island, Country Harbour; S. Point	45 4 55	61 36 28	
Cape Mocodome, on the S.W. of Country Harbour ... [5]	45 5 20	61 43 48	
White Point, on the W. side of Liscombe Harbour	44 59 2	62 2 0	
Mariet Joseph	44 56 40	62 5 8	
Cape Spry	44 48 25	62 36 33	
Taugier Island	44 44 28	62 41 0	
Jedore Head, on the West side of Jedore Harbour...... [6]	44 40 0	63 7 18	
Shut-in Island; S.W. End ...	44 36 35	63 19 38	
HALIFAX; Tablet in Dock-yard .... [7]	44 39 0	63 35 28	Captain W. F. Owen, H.M.S. *Columbia*, 1844.
Or, according to Lieut. Raper	* * *	63 37 26	
Sambro' Lighthouse, near Halifax Harbour	44 26 20	63 36 0	
Holderness Island, on the S.W. side of Margaret's Bay......	44 34 20	63 58 48	The Observations and Surveys of Jos. F. W. Des Barres, Esq., made pursuant to the Orders of the Admiralty of Great Britain, 1775, with subsequent emendations.
Green Island, off Mahone Bay	44 27 0	64 0 18	
Cross Island, off Lunenburg Harbour; *Lighthouse*	44 23 0	64 7 0	
Cape Le Have	44 15 0	64 18 48	
Port Medway, S.W. Head of	44 10 0	64 30 48	
Coffin's Island Lighthouse, near Liverpool Harbour	44 5 0	64 36 48	
Mouton or Matoon Island ...	43 57 0	64 43 48	
Point Hebert	43 51 0	64 53 8	
Shelburne or Cape Roseway; *Lighthouse*	43 40 30	65 14 23	
Cape Negro	43 32 0	65 18 48	
Cape Sable	43 24 0	65 37 18	
Brasil Rock	43 24 15	65 23 48	
Seal Island; *Lighthouse* ...[8]	43 23 54	66 0 18	
Cape Fourchu, near Yarmouth	43 47 30	66 12 18	
Cape St. Mary	44 5 0	66 15 48	
Bryer's Island; *Lighthouse* ...	44 14 30	66 23 48	The Surveys of M. Des Barres and others, with emendations, as shown in the *Colombian Navigator*, vol. i. 1847, pp. xv. and 30.—(*See Note* 7.)
Point Prim; *Lighthouse* (Entrance of Annapolis Basin...	44 41 30	65 48 18	
Cape Split, in the Mines Channel	43 21 40	64 52 48	
Cape Chignecto	45 22 0	64 51 18	
NEW BRUNSWICK.			
Cumberland; Fort	45 49 0	64 10 18	
Cape Enragée	45 36 0	64 29 48	
Quako Ledge, Middle of	45 17 6	65 11 48	
Cape Spencer	45 12 0	65 55 18	
Cape Maspeck	45 12 40	66 0 33	
Partridge Island; Lighthouse	45 14 0	66 3 0	
City of St John	45 15 30	66 3 18	
Fredericton, the Capital of New Brunswick	45 57 0	66 40 48	
Point Lepreau; *Lighthouse*...	45 4 0	66 26 48	
Wolf Islands; N.E. Point ...	44 59 0	66 42 48	

NOVA SCOTIA, ETC. (SOUTHERN COASTS)—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Beaver Harbour, S.W. Point	45 3 30	66 47 0	The Surveys of M. Des Barres, and others, with emendations, as shown in the *Colombian Navigator*, vol. i. 1847, pp. xv. and 30.—(*See Note* 7.)
Bliss Island, at the Entrance of Etang	45 2 30	66 53 0	
St. Andrew's; S.W. Point of Navy Island	45 3 30	67 7 0	
Head Harbour Lighthouse, on Campo Bello	44 57 0	66 58 0	
Grand Manan Island, &c.: Northern Point	44 46 49	66 50 0	
White Head Island; N.E. Point	44 37 40	66 44 0	
Gannet Rock Lighthouse	44 31 0	66 51 0	

NOTES.

1. SABLE ISLAND.—On this island there is an establishment for the relief of shipwrecked mariners, similar to that of Anticosti, described in Note 4, page 66.—For the particulars, see the *British American Navigator, &c.*, p. 168.

The establishment was founded in 1803, by the Provincial Legislature, at the recommendation of the late Sir John Wentworth, then Lieutenant-Governor; and has since proved the means of saving many lives.

There are now about twenty buildings on the island. The house occupied by the superintendent stands on the North side, at *eight* miles from the West end. Those uninhabited contain provisions, tinder-box, matches, &c. There are several fresh-water ponds, as shown on the particular chart; but wherever the surface is moist, fresh water may be obtained by digging from 1 to 3 feet deep.

The Signals established, and used to communicate with the island, by any vessel visiting or passing, are explained in the *Colombian Navigator*, 1839, vol. i. p. xviii. The flag used on the island is red, white, and blue, horizontally. A gun fired, particularly in hazy weather, will draw the attention of the inhabitants.

2. NOVA SCOTIA, in general.—"The climate of Nova Scotia is cold, the winter continuing from December to May. The earth is completely frozen from Christmas to April; during which period there are very heavy falls of snow. There is scarcely any spring; for, so soon as the frost and snow disappear, vegetation revives with such vigour, as, in a few days, to alter the whole face of the country. About the 1st of June the fields afford sufficient food for cattle. The heat of summer is both moderate and regular, being greatest in the month of August; and the nights are, generally, temperate. The autumn is the finest portion of the year: the mornings and evenings are cool, the temperature of the mid-day not unlike that of June, and the sky generally clear and cloudless. The month of April and the autumnal months are the most rainy; and fogs prevail on the southern shore, and at the mouth of the Bay of Fundy, in summer, but do not extend inland. The climate is remarkably healthy, and conducive to longevity. A great portion of the inhabitants live to a very advanced age, not uncommonly to 90 and 100 years. This great longevity was also observable among the Indians. The air is pure and wholesome; and there is nothing like that noxious miasma, which in the United States is the cause of intermittent fever. The intermittent, billious, and yellow fevers of America, have never appeared in the province; nor do any diseases prevail that are not usual and familiar in England. To say that the climate is not unhealthy, would convey but an inadequate idea of it. It is decidedly most salubrious, and congenial to the prolongation of human life, and proved by experience to be entirely beneficial to Europeans.

"The natural productions of Nova Scotia, independent of its riches in coal and minerals, consist of its timber and wild animals. The woods and timber are the same as are found in the other parts of North America;—the pine, in all its varieties; the birch,

which is considered as the best in America; oak, suitable for ship-building; spruce, hemlock, beech, ash, maple, and elm; all fit for boards, staves, and lumber; and an innumerable variety of other sorts of great beauty, but of minor value. The quantity of valuable timber is very great, and far from being exhausted, and enables the colonists to carry on a very extensive trade, in timber and lumber, to the mother country and the West Indies, as well as in the building and sale of ships, for which purposes it is as suitable as the timber of any other section of North America. There is a great variety of indigenous plants and flowers, some of them very beautiful, as well as of wild fruits, consisting of the sorts most common in Europe."—(*Bouchette*, vol. ii. p. 46.)

3. Canso Harbour is the harbour, or rather channel, formed by George's, formerly Canso Island. M. de Chabert, in 1750, stated this harbour to be in lat. 45° 20′ N., and lon. 60° 55′ W. The latitude here agrees with M. Des Barres, and the longitude is only 3′ more to the East. Mr. Lockwood, on the contrary, makes the latitude 2′ more North, and the longitude 2′ more to the West.

4. Raspberry Harbour is the Port Howe of the charts of M. Des Barres.—We have noticed, in a former work, that the bulk and price of the showy work of this gentleman never suffered it to come into general use; and, consequently, the new names which he assigned to different points and places have remained generally unknown. Mr. Lockwood says,—"The original names of the places are restored, by which only they are known to the inhabitants and fishermen. M. Des Barres, in attaching to them the names of noblemen, and men in power, has made his charts of less value; and, in one or two instances, has created serious blunders. Inquire of the people of Jedore for Port Egmont, or those of Sheet Harbour for Port North, they know them not; nor would they ever be induced to adopt them. Jestico, a harsh, unpleasant, and unmeaning name, is preferred to Port Hood, although the latter is more pleasing to the ear, and pronounced and recollected with ease: all attempts to change the rude Indian names for others of a finer texture have failed; even New Jerusalem and Acadia have expired."

5. Cape Mocodome, &c.—This cape is represented, by Mr. Lockwood, in lat. 45° 3′ N., and lon. 61° 36½′ W.; and, in other instances, this gentleman's results differ from those of M. Des Barres; but, as we are unacquainted with the nature of his observations, we cannot with propriety substitute them for the latter, of which the particulars are known.

6. Jedore Head.—In the *Colombian Navigator*, vol. i. 1839, page ix., the latitude of Jedore Head is misprinted; it should be 44° 40′, as in the preceding Table.

7. Halifax.—It may not be improper to repeat the note on Halifax, already given in the *Colombian Navigator*, as follows:—"The latitude of the Naval Yard of Halifax, from observations very carefully made by the officers of H.M.S. *Niemen*, in 1822, was 44° 39′ 37″. This was gained by eleven *meridian* altitudes with the artificial horizon, and several observations made on each side of noon at small intervals; the mean true altitudes being computed from the hour angles. The longitude, 63° 33′ 43″, was obtained as the mean result of more than thirty sets of lunar distances. We formerly gave the longitude from M. Des Barres, &c., as 63° 32′ 40″, and therefore presume that a statement of 63° 37′ 48″, which has lately appeared, is 4′ too far West."

The preceding note was given in the previous editions of this book, and the doubt expressed by Mr. Purdy as to Lieutenant Raper's longitude being in excess, is, in some measure, confirmed by the result of Captain Fitzwilliam Owen's recent observations, as given in the Table, which would place Halifax between Lieutenant Raper's, and the longitude as formerly given by Mr. Purdy. See Note 6, on Quebec, page 67.

8. Seal Island.—M. Des Barres places the southernmost point of the southern Seal Isle in lat. 43° 25′ 25″, and lon. 66° 0′ 35″. Later charts have it in lat. 43° 26′ 35″; but our friend and correspondent, Lieutenant Hare, gives the latitude of the South point 43° 22′ 23″, or *four miles more to the southward.* "The latitude," says Lieutenant Hare, "I had an excellent opportunity of ascertaining exactly at noon of a very clear day, 1st of May, 1828. This result, *since confirmed*, will account for so many ships having been yearly cast away on coming out of the Bay of Fundy. On the supposition of these vessels being far enough to the southward to clear all danger, they may have bore away to the S.E., and thus have been lost. A very strong in-draught, both on the ebb and flood, sets toward the isles, and in their vicinity, equal to 4 knots an hour, and *they should not be approached without a commanding breeze.*"—(See more upon this subject in vol. i. of the *Colombian Navigator*.)

VARIATIONS of the COMPASS.—In the year 1775, the variations were given

by M. Des Barres, as follow:—North Entrance of the Gut of Canso, 16° W.: Crow Harbour, Chedabucto Bay, 14° 50′ W.. Entrance of Liscombe Harbour, 14°: Sable Island, 13° 57′: Halifax Lighthouse, 13° 35′: Entrance of Shelburne, 13° 30′: Cape Sable, 11° 15′.

In 1798, Mr. Backhouse, of the Navy, found the variation at Halifax to exceed 16°. According to Colonel Bouchette, it was 17° 0′ 10″ at that place in 1830; at Sambro Lighthouse, in 1828, 16° 45′; and at Cape Sable, 14°. So that since 1775 it has increased nearly 3¼°; but whether it be still on the increase hereabout is questionable. At Halifax it is 16° 46′ W. (1844.) At St. John's, New Brunswick, the present variation is about 16°, and in Passamaquoddy Bay, 15°.

THE PHAROLOGY OF NOVA SCOTIA AND NEW BRUNSWICK.

(The table, and the signs in the *third* column, are explained on pages 14 and 16.)

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
GUYSBOROUGH HARBOUR. One bright fixed light.	A square white beacon, 20 ft. high, on the W. side of the entrance in Chedabucto Bay.	●	30	8	1846
CAPE CANSO. Two bright fixed lights, vertical.	In one octagonal tower, 60 feet high, 35 feet apart. The tower painted red and white horizontally, on the N. part of Cranberry Island.		75 40	15 9	1815
BEAVER ISLANDS. One bright revolving light every 2 minutes.	A white tower, with two black balls seaward, 35 feet high, on the S.E. part of E. Beaver or William Island.		70	12	1846
HALIFAX HARBOUR. One fixed *red* light.	A circular white tower, with a red roof, 48 feet high, on Maugher's Beach, E. of entrance.	●	58	10	1815
SAMBRO ISLAND. One bright fixed light.	A white octagonal tower, 60 feet high. A gun fired during fogs will be answered from the island. Pilots resort there.	●	132	20	1758
MALAGUASH or LUNENBURG BAY. Upper light intermittent, bt. 45 sec., ecl. 15 sec. Lower lt. bright and fixed.	A red tower, 50 feet high, the lights vertical, 34 feet apart, on Cross Island, S.E. point.	●	90 56	14 8	1839
LIVERPOOL BAY. One bright revolving light every 2 minutes.	An octagonal tower, 58 feet high, red and white horizontal, on Coffin Island, S. point.	●	80	16	1812
SHELBURNE HARBOUR. Two bright fixed lights, vertically.	An octagonal tower, 70 feet high, black and white vertical stripes, on Cape Roseway, on S.E. point of M'Nutt's Island.	●	100 62	18 10	1788
CAPE LATOUR, or BACCARO POINT. One intermittent light, bt. 15 sec., dark 25 sec.	A square white tower, with black ball seaward, 35 feet high, on the point.	●	49	12	1850
SEAL ISLAND. One bright fixed light.	An octagonal tower, 60 feet high, on the S. point, half a mile inland.	●	60	18	[illegible]
CAPE FORCHU. One bright revolving light every 1½ minutes.	An octagonal red and white tower, 58 feet high, red and white vertical, on the S. point of the E. cape of Yarmouth.	●	145	20	1839
BRYER ISLAND. One bright fixed light.	An octagonal white tower, 55 feet high, on the W. part, half a mile in-shore.	●	92	16	1809 1839
PETER ISLAND. Two bright fixed lights.	A square white tower at the S. entrance to West port in the Grande Passage, seen from S. between N. 54° E. and N. 25° W., and from N. between S. by W. and S.S.W.	●	40	10	1850
ANNAPOLIS or DIGBY GUT. One bright fixed light.	A square tower, 22 feet high, red and white vertical, on Point Prim, S. side of entrance.	●	76	13	1817

Name and Description of Light.	Situation, &c.	Description of Apparatus.	Height above High Water.	Visible in Miles.	Year erected.
BLACK ROCK. One bright fixed light.	A square white tower, 35 feet high, on Rock Point.		45	18	1848
APPLE RIVER. Two bright fixed lights, horizontal, 24 ft. apart.	A square white tower, 24 feet high, on Cape Capstan or Hetty Point, N. entrance.	●	40	10	1848
CAPE ENRAGE'. One bright fixed light.	A square white tower, 23 feet high, on the pitch of the cape; visible from N.W. by S. to N.E.	●	151	15	1840
QUACO HEAD. One bright revolving light every 20 seconds.	An octagonal tower, 46 feet high, with red and white horizontal stripes, on an islet.	●	70	15	1835 1848
ST. JOHN'S, PARTRIDGE ISLAND. One bright fixed light.	An octagonal tower, 40 feet high, striped red and white vertically, on Partridge Island. A bell in fogs.	●	119	20	1791 1832
ST. JOHN'S, BEACON TOWER. One bright fixed light.	An octagon, striped white and black vertically; leading-mark for the spit.	●	35	10	1828
LEPREAU POINT. Two bright fixed lights.	An octagonal tower, 31 feet high, red and white horizontally, on the point. The lights vertical, 28 feet apart.	●	81 53	15	1831
CAMPO BELLO ISLAND. One bright fixed light.	A white octagonal tower, 34 feet high, with a red cross on the N part of the island.	●	64	15	1829
ST. ANDREW. One bright fixed light.	An octagonal white tower, 22 feet high, on Indian Point, N. entrance to the port.	●	35	10	1833
MACHIAS SEAL ISLANDS. Two bright fixed lights.	Two white towers, 200 feet apart, E.S.E. and W.N.W., with the keeper's house between, on the eastern isle.	●	48	15	1832
GANNET ROCK. A revolving light every 20 seconds.	An octagonal tower, 41 feet high, striped half black half white vertical, on the S. part. *To be approached with caution.* A gun fired to answer signals.	●	66	12	1831

13. THE UNITED STATES.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
West Head; Passamaquoddy; *Lighthouse*	44 48 0	66 57 0	The Surveys of New Hampshire, &c., and Observations of the Surveyor-General, S. Holland, Esq., compared with Observations made by M. Chabert, Dr. Williams, Dr. Winthrop, &c.
Petit or Little Manan; *Lighthouse*	44 24 0	67 46 0	
Mount Desert Rock; *Lighthouse*	43 52 0	68 3 30	
Isleboro', or Long Island, the Bay of Penobscot; South End [1]	44 14 0	68 46 0	
White Head; *Lighthouse*	43 59 0	68 58 0	
Portland; *Lighthouse*	43 36 30	70 10 0	
Cape Elizabeth; *N.E. Lighthouse*	43 34 0	70 9 0	
Wood Island; *Lighthouse*	43 27 0	70 17 30	The Trigonometrical Survey of Massachusets, by Messrs. S. Borden and R. T. Paine, 1844.
Boon Island; *Lighthouse*	43 7 30	70 27 30	
Portsmouth; Unitarian Ch. [2]	43 4 34	70 45 50	
Newbury Port; Harris St. Ch.	42 48 32	70 52 47	
Cape Anne Lights	42 37 0	70 33 0	

THE UNITED STATES—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Gloucester; 1st Independent Chapel	42 36 44	70 40 19	The Trigonometrical Survey of the State of Massachusets, by Messrs. Simeon Borden and Robert Treat Paine, 1844.
Salem; East India Marine Hall	42 31 19	70 53 56	
BOSTON; State House...[3]	42 21 22·7	71 4 9·0	
Boston Harbour; *Lighthouse*	42 20 36	70 54 0	
Cambridge; 1st Congregational Church..................	42 22 21	71 7 38	
Plymouth; Court House	41 57 28	70 40 27	
Sandwich; 1st Congregational Church	41 45 31	70 30 27	
Barnstaple; New Court House	41 42 7	70 18 36	
Truro; *Cape Cod Lighthouse*.	42 2 22	70 4 8	
Monomoy Point; *Lighthouse*.	41 33 30	70 0 5	
Nantucket; South Tower......	41 16 56	70 6 12	
Holmes Hole; Windmill West of Hill	41 27 15	70 36 37	
New Bedford; Mariner's Ch.	41 38 6	70 55 49	
Bristol; Episcopal Church ...	41 40 2	71 17 19	
Taunton; Trinitarian Church	41 54 8	71 6 4	
PROVIDENCE; University Hall	41 49 31	71 34 23	
Montuk Point, East End of Long Island; *Lighthouse*...	41 1 0	71 59 44	Inferred from the Position of New York, by Mr. De Witt's Survey.
Five Islands Inlet; *Lighthouse*	40 37 10	73 12 45	
NEW YORK; Cupola of Colombia College.........[4]	40 42 43	74 0 11	Latitude, Captain Edward Sabine, &c. Longitude by chronometric admeasurements, as shown in the Note.
———; City Hall ...	40 42 20	74 0 15	
———; Fort Flagstaff	40 42 10	74 0 23	
Sandy Hook; *Lighthouse*......	40 27 30	73 59 54	
Cape May; *Lighthouse*.........	38 57 0	74 55 45	Deduced from Cape Henlopen.
Cape Henlopen; *Lighthouse*[5]	38 46 40	75 5 15	M. de Chabert, compared with the Provincial Surveys.
PHILADELPHIA; Christchurch, in Second Street [6]	39 56 54	75 10 30	The Observations of Messrs. Mason, Dixon, and Pryor, on the transit of Venus, 1769, with a subsequent correction.
Norriton Observatory ......[7]	40 9 56	75 22 30	Dr. David Rittenhouse, compared with Howell's Survey of Pennsylvania, &c.
Cape Henry; *Lighthouse*...[8]	36 56 30	76 4 0	Latitude, Captain Penrose, Lord Cochrane, and Mr. Downie, 1795. Longitude inferred from that of Washington, &c.
WASHINGTON; Capitol[9]	38 53 0	77 0 20	Latitude, Mr. Andr. Ellicott. For Longitude, see Note 9.
Cape Hatteras; *Lighthouse*[10]	35 15 0	75 30 0	American Officers on the Survey.
Cape Fear; *Lighthouse*	33 51 45	78 0 40	
——— ; S.E. Point	33 49 0	77 57 30	
George Town.....................	33 13 0	79 2 40	Inferred from the Position of Cape Fear.
Cape Roman	33 1 0	79 16 0	
CHARLESTON; *Lighthouse*[11]	32 40 0	79 54 0	
Savanna; *Tybee Lighthouse*...	32 0 40	80 40 0	Latitude, M. Chabert.
Cumberland Island, South End........ ....[12]	30 43 15	81 35 30	Mr. Andrew Ellicott.
River Nassau; Entrance of *South Channel*	30 28 0	81 33 30	The Observations of Don José Joaquin de Ferrer, &c.

THE UNITED STATES—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
River S. Juan ; Bar	30 21 0	81 32 30	The Observations of Don José Joaquin de Ferrer, and other Spanish Officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
St. Augustin ; *Lighthouse*	29 53 0	81 24 30	
Matanza Inlet	29 42 0	81 19 30	
Cape Canaveral ; South Point	28 28 0	80 32 0	
Biscayno Kay ; *Lighthouse*	25 41 0	80 5 0	
Looe Kay ; Beacon Tower	24 31 30	81 31 0	The preliminary Observations by the Officers of the United States' Coast Survey.
Kay West ; *Lighthouse*	24 32 32	81 48 30	
Sand Kay ; *Lighthouse*	24 28 30	81 49 30	
Tortugas ; Bush Kay *Lighthouse*	24 37 20	82 52 22	
Tortugas Bank ; Shoalest Part	24 25 0	83 5 0	
Dog Island Lighthouse, East Pass of Apalachicola	29 43 15	84 42 15	
Cape St. George ; Lighthouse	29 37 0	85 9 15	
St. Joseph's Bay ; Entrance, Lighthouse	29 51 50	85 27 45	
Pensacola ; Lighthouse	30 20 17	87 16 15	
Mobile Point ; Lighthouse	30 13 42	87 58 30	
Sand Island Lighthouse ; Mobile Bay	30 11 0	87 59 37	
Mississippi River ; N.E. Pass Lighthouse	29 8 22	89 1 40	
——— ; S. Point ; Lighthouse	28 59 17	89 7 24	
——— ; S.W. pass ; Lighthouse	28 59 27	89 20 50	
NEW ORLEANS ; City of [13]	29 57 45	90 0 12	
Point Fierro or De Fer ; *Light*	29 19 30	91 33 0	
Galveston Bay ; Bolivar Point, East side of entrance	29 22 0	94 48 0	

NOTES.

GENERAL NOTE.—In the year 1807, the United States' Legislature determined upon the survey of the coast. This was not properly commenced until 1817, when some base lines were measured, and triangles taken. In 1832 the operations were resumed, under its original superintendent, Mr. *F. R. Hassler*. In 1842 "the works of the survey of the coast cover now upwards of 11,000 square miles, with primary and secondary triangulation, topography, and soundings, from the East end of Rhode Island to the neighbourhood of the Chesapeake and Cape May." "Special surveys have been made also of the Harbours of Bridgeport and Newhaven, and the Bay of Newark. The Bay of New York is in progress of engraving." The expenditure on this service, between 1832 and 1841, was 620,000 dollars. The account of the progress, &c., of the coast survey, is given in Professor Schumacher's "Astronomische Nachrichten," Nos. 453 and 454, July, 1842.

1. ISLEBORO', or LONG ISLAND, &c.—The position of this island was determined in 1780 by Dr. Williams, Dr. Winthrop, and other American astronomers, from a total eclipse of the sun, September 27.

2. PORTSMOUTH.—We have extracted the positions of the places between this and the Bay of Rhode Island from "An Account of a Trigonometrical Survey by Simeon Borden, Esq., and Astronomic Observations by Robert Treat Payne, Esq., by Order of the Legislature of the State of Massachusets," as detailed in the *Transactions of the American Philosophical Society*, 1844, page 54, where the positions of twenty-seven points in Massachusets are given : these, though not strictly nautical, are presumed to be more accurate than those formerly stated, and, therefore, have been preferred.

3. BOSTON.—Dr. Bowditch, from six astronomic observations, viz., two transits and four solar eclipses, made the longitude of Boston as $4^h\ 44'\ 16{\cdot}6''$; and it was the opinion

of Dr. Bowditch that this longitude was more accurately ascertained than that of any other place in the United States. "From observations in 1829 and 1830," continues Mr. Borden, "I made the longitude of the State House as 4^h 44′ 14·6″; and by the great solar eclipse, May 15th, 1836, 4^h 44′ 19·6″: mean of the whole, 71° 4′ 13·5″, or 4″ more than in the Table. The latitude deduced is from 636 observations.

4. NEW YORK.—In the *Ladies' and Gentlemen's Diary*, or *United States' Almanac*, for 1820, Mr. Nash, the editor, having the reputation of an excellent observer, gives particulars of a great many meridian and circum-meridional observations, taken at his school, Broadway, New York, from which he infers the latitude of No. 331, Broadway, as 40° 42′ 58″. The difference of latitude, trigonometrically found, between Mr. Nash's and the City Hall, was somewhat less than 1,300 feet; which, assumed as 13″, gives the latitude of the City Hall as 42° 42′ 45″, *i. e.*, allowing 40° 42′ 58″, as the latitude of No. 331, Broadway. By observations of a solar eclipse, which Dr. Bowditch observed at New York, he found the difference of longitude between Greenwich and Colombia College equal to 74° 0′ 45″ W. On the 29th of May, 1818, at a few minutes past noon, the longitude at No. 331, Broadway, by the mean of three distances of the sun and moon, appeared to be 74° 0′ 42″; and Mr. Nash adds, "I am inclined, for the present, to place the City Hall in 74° W."

By seventy lunar distances, forty of *Pollux* East, and thirty of *Aldebaran* West, of the moon, in December, 1822, and January, 1823, *Captain Sabine* gave the longitude of the cupola of Colombia College, New York, as 74° 3′ 27″; and the latitude which he assigns to it is 40° 42′ 43″. Mr. De Witt, on his survey of the province, gave the longitude as 74° 3′.

The chronometers of Messrs. Arnold and Dent, however, appear to have finally decided the longitude of New York. Four of them were embarked in the *British Queen* steam-vessel, under the care of Captain Roberts, on her first voyage from England to America, in July and August, 1839, and gained the longitude of the City Hall in New York, as 4^h 50′ 3·35″ (= 74° 0′ 49″). A second experiment was made on the next voyage of the same vessel, in October and November of the same year, by another set of four chronometers, and by this the difference of longitude between the Observatory at Greenwich, and the City Hall, New York, appeared to be 4^h 56′ 0·24″. Say 74° 0′ 10″. M. Daussy, the French hydrographer, had previously given it in the *Connaissance des Tems* as 4^h 56′ 0·72″, or 74° 0′ 11″; and we may conclude that it does not exceed 4^h 56′ 1″, or 74° 0′ 15″, as shown in the Table.

The details of the two chronometrical experiments, written by Mr. Dent, and involving some interesting and important facts, are given in the *Athenæum*, Nos. 621 and 629, September and November, 1839.

5. CAPE HENLOPEN.—The longitude, as given by M. de Chabert, is 75° 12′ 30″, as since in the *Connaissance des Tems* and *Requisite Tables*. But the maps prove that this, also, is too far to the West.

6. PHILADELPHIA.—The original deduction of the longitude of Philadelphia was 75° 13′ 45″, and of Norriton, 75° 28′ 30″, as in the Requisite Tables; but we have given Norriton according to its distance from Philadelphia, by Mr. Howell's survey.

7. NORRITON is an inland town, about 16 miles to the N.W. of Philadelphia, but celebrated for the Observatory of the late astronomer, Dr. David Rittenhouse.—See Note 19, *Colombian Navigator* 1839, vol. i. p. 24.

8. CAPE HENRY.—The result of observations made by Lord Cochrane, Captain Penrose, and Mr. Downie, of the British Navy, in 1795, gave 76° 16′ as the longitude of Cape Henry. M. Chabert had previously placed it in 76° 31½′, as it has since stood in the Requisite Tables. Admiral Espinosa's chart of 1811 places it in only 75° 46′; Mr. De Mayne's chart (1820), in 75° 47′; and we have no longer any special reason for placing it to the *westward* of the meridian assigned in the Table, although in a late chart it is represented in 76° 5′ W.

9. WASHINGTON.—As inferred from the observations made at Cape Henry, Washington was formerly placed in 77° 14′ W. Dr. Bowditch's Navigation, 1817, gave it 77° 16′. The *American Coast Pilot* now gives it in 77° 3′, while every other modern document gives it more to the eastward. We have already shown, in the *Colombian Navigator*, Note 21, vol. i. p. xxiv., the reasons for adopting 77° 0′ as the meridian of Washington; and by reference thereto, it will be found that the true longitude is rather to

the eastward than to the westward of the same. The French Tables give it as 76° 59′; Mr. Simeon De Witt, the able surveyor of the state of New York, as 76° 57′ 30″.

10. Cape Hatteras, &c.—The correction of longitude, explained in the preceding Note, continues and blends with that produced by the observations of Mr. Ellicott on Cumberland Island.

11. Charleston.—We formerly stated the position of Charleston on the authority mentioned in the *Colombian Navigator*, vol. i. p. xxv., as 32° 40′ 49″, and 79° 52′, for which we now substitute 32° 46′ N., and 79° 48′; the reasons are assigned in the same work.

12. Cumberland Island, &c.—It appears, upon examination, that Cumberland Island, with all the coast to the southward, was, previous to the year 1799, exhibited much too far to the westward in all existing charts and maps. Some observations by Mr. Charles Roberts, published in 1794, placed Cape Canaveral in 81° 28′, and Cape Florida in 81° 13′ West of Greenwich, or more than a degree to the westward of the longitude now assigned.

For the position given in the Table we are indebted to the "Journal of Mr. Andrew Ellicott," Commissioner on behalf of the United States for determining the boundary of the Spanish Possessions, during part of the year 1796, the years 1797-98-99, and part of 1800. Quarto, Philadelphia, 1803. The following are the results of the observations made for the longitude at the South end of the island, in the year 1800.

		In Time. H.	M.	S.
March 13.	Emersion of the 1st satellite of Jupiter	5	26	29
15.	Emersion of the 2nd satellite	5	26	33
17.	Lunar Observation	5	26	59
—	Another Lunar Observation	5	26	25
—	A third Lunar Observation	5	27	25
25.	Emersion of the 3rd satellite of Jupiter	5	26	14
26.	Emersion of the 4th, by the *Nautical Almanac*	5	51	48
—	Emersion of the 4th, by Delambre's Tables	5	27	37
27.	Emersion of the 1st satellite of Jupiter	5	25	43
30.	Lunar Observation	5	26	6
April 1.	Immersion of the 3rd satellite of Jupiter	5	24	6
—	Emersion of the same	5	26	0
2.	Emersion of the 2nd satellite of Jupiter	5	26	49
5.	Emersion of the 1st satellite	5	26	40
9.	Emersion of the 2nd satellite	5	26	57

Thus ultimately the longitude, in time, was concluded to be 5^h 26′ 22″, equal to 81° 35′ 30″, and the latitude 30° 43′ 15·8″. Our plan does not admit of a further detail of this important result. We give the example as one which, if repeatedly imitated on important points, would lead to incalculable improvements in practical geography.

The Spanish Surveyors give the Bar of St. Mary's River in 30° 45′ N., and 81° 32½′ W. This, it may be noticed, corresponds very nearly with Commissioner Ellicott's determination, and it also accords with many meridional observations taken by Captain William Tulloch, of Portsmouth, in New Hampshire.

13. New Orleans, &c.—The position adopted by Mr. Gauld, in his survey of West Flroida, made in the years 1764 to 1771, and first published, on four sheets, in 1803, is 29° 57′ 45″ N., 90° 8′ 0″ W. The same position has been assumed by Mr. Darby, in his survey of Louisiana, published in 1816: but the Spanish charts give the longitude rather more to the eastward, and the *Connaissance des Tems* gives it as 89° 58′ 30″. The chart of Admiral Espinosa (1811) represents it as in 90° 6′ W.

The longitude computed by M. Ferrer, from astronomical observations, was 90° 6′ 8″; and from other observations, 90° 8′ 8″, as it appears in the *Connaissance des Tems*, 1817; and by M. Daussy it is placed in 90° 7′ 0″. These would all seem to confirm the positions given by M. Gauld: but according to the connected triangulation of the United States' Coast Survey, it is on the 90th meridian.

The longitude of New Orleans is of some interest. The United States' Coast Survey has assumed a considerable degree of importance from its extent, and these results being extended to the other portions of the territory, render the consideration of a *primary*

meridian for the western world one necessary to be determined in the early state of the operations.

The capitol of Washington would naturally appear to be the fittest starting point; but as the introduction of greater diversity in astronomic and other tables than at present exists is certainly not desirable, the United States' Survey Department commissioned Professor Bache to report on the subject. Impressed with the inconvenience attached to the introduction of a fresh mode of reckoning meridional distances, and at the same time to give due importance to the geodetical operations carried on in America quite independent of any in the eastern hemisphere, he recommended, if any transatlantic meridian were to be assumed as a primary, that that of *New Orleans* would be the fittest.

The progress of the survey having shown that New Orleans was in lon. 90° 0′ 0″, or nearly so, it became manifest that one objection to a new fractional element being introduced was in some degree removed if this were taken. With this view, if any meridian were to be assumed for the United States, that of 90° West of Greenwich, *wherever it may fall*, is the fittest. If in the course of the operations any correction be found necessary to this meridian, as marked in some part of New Orleans, let it be removed accordingly. Thus the first meridian of the United States would be one-fourth of the circumference, or six hours in time West of that of Greenwich.

VARIATIONS OF THE COMPASS.—The following are the variations as given on the surveys of Samuel Holland, Esq., in 1775. It appears, from later works, that the variation in Massachusets Bay, &c., is a degree less, at present, than when these observations were made.

Off Machias Bay, 13° W.: off Mount Desert Isle, 10° 30′: Bay of Penobscot, 10°: near Isle Haute, 9°: near Mauheigin Isle, and thence to Portland, 8° 30′: Portsmouth, 7° 48′: off Newbury Port, 7° 40′: Boston Bay, 7° 40′: Plymouth Bay, 7°: between Nantucket and Martha's Vineyard, 6° 30′: off Rhode Island, 6° W.

The present variation at Machias Bay is 12° W.: Bay of Penobscot, 9°: near Cape Elizabeth, about 8°: at Portsmouth, 7°: Boston and Cape Cod, about 6°: New York Harbour, 3°: off the Delaware, 2½°: and near Cape Henry, 1½° West. The *westerly* variation appears to cease between Cape Henry and Cape Hatteras; for near the latter the variation becomes *easterly;* and in the vicinity it is half a degree East. On the coast of South Carolina it is 3°; and at the head of the Maternillo Bank, 5° *East.*

In 1771, Mr. Gauld gave the variation near the entrance of the Mississippi as 6° 37′ E.; Mr. Romans, nearly at the same time, found it, near the Bay of Espiritu Santo, to be 5° 47′ E.: and from observations made more to the southward, in and subsequent to 1807, we infer that it is, at present, nearly 1° more to the East. From six amplitudes taken by Captain Livingston, on his passage from and to New Orleans, in 1818, the variation on the meridian of the Dry Tortugas, in lat. 23° 45′, appeared to be 6° 33′ E. In lat. 25° 15′, lon. 85° 20′, 8° 20′ E.: in lat. 25° 55′, lon. 85½°, 9° 30′ E.: in lat. 26° 55′, lon. 86° 15′, 6° 49′ E. We are not acquainted with the position of the ship's head at the time of observation; and for this deficiency, due allowance must be made. At the entrance of the harbour of Mobile, the variation has been given as 6° 58′ E., in 1828.

The discordance of numerous results of observations for variation on these coasts has occasioned the rejection of nearly one-half of the number that have come to the hands of the Editor. That discordancy has undoubtedly arisen from the various positions, &c., of the ships in which the observations were made, as explained in the Appendix hereafter.

But it seems, too, that some other cause may derange the compass in particular situations. Captain Livingston has the following remarks:—

"At a considerable distance from land, or about the inner edge of the Gulf Stream, off the entrance of the Chesapeake, I saw a brigantine, apparently a very fine and fast one, steering very wild, and yawing about in almost every direction, and, for a time, I wondered much at it; but, when I had run a few miles farther North, so as to be nearly in the same position as she was when I first saw her, our compasses appeared to become perfectly useless, or so nearly useless, that, having a tolerably good horse-shoe magnet on board, I touched all the three we had without effect; but when we had run 6 or 7 miles farther, the compasses traversed freely as before.

"Off the Chesapeake, I am, therefore, convinced that something more than the iron in a vessel, and her position, affects the compass-needle very strongly."—*A. L.*, *Dec.* 1817.

THE PHAROLOGY OF THE UNITED STATES.

Name and Description of Light.	Situation, &c.	Height of Building	Height above High Water	Visible in Miles.	Year erected
West Quoddy Head. One bright fixed light.	On the head, near Eastport, S. side of entrance.	45	90	17	1806
Little River. One bright fixed light.	In Cutler.	23			1847
Libby Island. One bright fixed light.	On island, entrance to Machias Bay.	30	60	15	1822
Moose Peak Islands. One bright revolving light every 4 minutes.	Mistake Island.	35	54	15	1826
Nashe Island. One *red* fixed light.	E. side of Pleasant River.	25	47	12	1838
Petit Manan Island. One bright fixed light.	S. end of island.	25	53	14	1817
Prospect Harbour. One bright fixed light.	In Town of Goldsborough.				1849
Baker's Island. One bright fixed light.	Off Island of Mount Desert.	25	70	17	1828
Bear Island. One bright fixed light.	Cranberry Islands.	17	95	12	1839
Mount Desert Rock. One bright fixed light.	Near the Island of Mount Desert.	42	56	15	1830
Saddleback Ledge. One bright fixed light.	A granite tower, near S.W. end of Haut Island.	32	62	14	1839
Brown's Head. One bright fixed light.	On southern end of Fox Islands.	20	42	13	1832
Eagle Island. One bright fixed light.	On island.	25	100	12	1837
Dice's Head. One bright fixed light.	On the head, near Castine.	40	116	17	1828
Fort Point. One bright fixed light.	Old Fort Point above Castine.	24	90	12	1836
Grindel Point. One bright fixed light.	Gilkey Harbour, Penobscot Bay, Long Island.		30		1850
Negro Island. One bright fixed light.	S. side of entrance to Camden Harbour, Penobscot Bay.	20	50	12	1835
Goose River. One *red* fixed light.	Indian Island, Penobscot Bay.		40		1850
Owl's Head. One bright fixed light.	Western entrance of Penobscot Bay.	15	117	15	1825
Whitehead Island. One bright fixed light.	On island, entrance of Penobscot Bay.	30	58	15	[illegible]
Martinicus Rock. One bright fixed light.	On rock, Penobscot Bay.	30	82	17	1827
Marshall's Point. One bright fixed light.	On point.	20	30	12	[illegible]
Monhegan Island. One revolving light, bright and *red* alternately, every 2½ minutes.	On island.	30	170	25	1824
Franklin Island. One bright fixed light.	N. end of island.	30	[illegible]	14	1806
Penmaquid Point. One bright fixed light.	On point, near Bristol Bay.	6	[illegible]	[illegible]	1827 1835
Burnt Island. One bright fixed light.	On island, W. side of Townshend Harbour.	20	55	14	1821
Hendrick's Head. One bright fixed light.	On the head, E. side of Sheepscot River.	24	39	18	1829

Name and Description of Light.	Situation, &c.	Height of Building.	Height above High Water	Visible in Miles.	Year erected.
Pond Island. One bright fixed light.	Western entrance of Kennebec.	13	52	13	1821 1835
Seguin Island. One bright fixed light.	On island of Kennebec River.	20	166	22	1795 1819
Portland. One bright fixed light.	On the head, S. side.	45	80	19	1791 1813
Cape Elizabeth. One rev. lt. every 2 min. One bright fixed light.	On the cape.	50	140	25	1828 1844
Wood Island. One bright revolving light every 1½ minutes.	On island, near Saco Harbour.	45	63	18	1808
Goat Island. One bright revolving light.	Mouth of Cape Porpoise Harbour.	20	33	13	1833
Boon Island. One bright revolving light	On island.	50	70	17	1812 1831
Whale's Back. Two bt. fixed lts. vertical.	N. and E. side of Portsmouth Harbour, outer entrance.	40	58	16	1829 1850
Portsmouth. One bright fixed light.	Inner entrance of Portsmouth Harbour, S.W. side.	80	90	18	1804 1838
White Island. One revol. lt., bt. and *red* alternately every 3½ min.	South-western island of the Isle of Shoals.	40	87	21	1821 1841
Plumb Island. Two bright fixed lights.	On island, S. side of entrance to Newbury Port	38	54	15	1842
Ipswich Harbour. One bright fixed light. One bright revolving light.	Patche's Beach, S. side of the harbour.	30	40	14	1837
Wigwam Point. One bright fixed light.	E. side of entrance to Squam Harbour.	30	50	13	1801 1843
Straitmouth Harbour. One bright fixed light.	On island, N. side of Cape Ann.	18	40	13	1835
Thatcher's Island. Two bright fixed lights.	On island.	37	[redacted]	21	1841
Gloucester Point. One bright fixed light.	On point, E. side of Gloucester Harbour.	30	57	19	1831
Ten Pound Island. One bright fixed light.	On island, Gloucester Harbour.	20	45	13	1821 1843
Baker's Island. Two bright fixed lights.	On island, S. side of N.E. entrance to Salem Harbour.	46 25	81 70	20	1797 1846
Marblehead Harbour. One bright fixed light.	E. entrance to harbour, S.E. side.	20	40	14	1835 1845
Boston. One bright revolving light every 3½ minutes.	N. entrance of harbour.	60	90	25	1839
Boston Bay. One *red* fixed light.	At Scituate, on Cedar Point.	25	40	14	1851
Long Island Head. One bright fixed light.	N. end of island.	22	80	15	1819 1844
Minot's Ledge. Washed away.	On ledge. Cohasset Rocks. Now a floating light.	78			1850
Plymouth. Two bright fixed lights.	Garnet point, N. side of harbour.	28	90	18	1769 1842
Sandy Neck. One bright fixed light.	W. side of entrance to Barnstaple Harbour.	24	40	13	1826
Billingsgate Island. One bright fixed light.	On island, W. side entrance to Wellfleet.	24	40	13	1822 1834
Long Point. One bright fixed light.	Long Point Shoal.	18	35	13	1826
Race Point. One bright revolving light.	North-westerly point of Cape Cod.	25	32	15	1816 1845

Name and Description of Light.	Situation, &c.	Height of Building.	Height above High Water.	Visible in Miles.	Year erected.
CAPE COD HIGHLANDS. One bright fixed light.	On Cape Truro.	45	180	27	1797 1839
MAYO'S BEACH. One bright fixed light.	Head of Wellfleet Bay.	21	[illegible]		1838
NAUSET BEACH. Three bright fixed lights.	E. side of Cape Cod.	15	90	16	1837
CHATHAM HARBOUR. Two bright fixed lights.	Inside the harbour.	40	70	17	1808 1841
MONAMOY POINT. One bright fixed light.	Sandy Point, S. extremity of Cape Cod.	24	25	12	1823
NANTUCKET ISLAND. One bright fixed light.	N. point of island.	60	70	20	1769 1845
SANKATY HEAD. One bt. light, varied by bt. flashes at intervals of 1½, 1½, and 3 min. altern.	The tower painted in three horizontal rings, on the S.E. part of Nantucket Island.	70	150	12	1849
NANTUCKET BEACON. One bright fixed light.	Brant Point.	24	140	14	1794 1812
NANTUCKET HARBOUR LT. One bright fixed light.	S. side of the harbour.	24			1820 1825
NANTUCKET CLIFF. Two bright fixed lights.	In harbour.				1838
TUCKANUCK SHOAL LT.-VES. One bright fixed light.	On Cross Rip, N.W. of Nantucket.		38		1828
POINT GAMMON. One bright fixed light.	On the point, S. side of Cape Cod.	20	70	17	1816 [illegible]
HYANNIS BREAKWATER. One bright fixed light.					1850
CAPE POGE. One bright fixed light.	N.E. point of Martha's Vineyard.	30	55	16	1801 1844
EDGARTOWN. One bright fixed light.	Entrance of harbour.	96	[illegible]	[illegible]	1828
HOLME'S HOLE. One bright fixed light.	W. chop of harbour.	32	60	[illegible]	1817
GAYHEAD. One bright revolving light every 4 minutes.	W. point, Martha's Vineyard.	38	172	25	1799
NOBSQUE POINT. One bright fixed light.	On the point, in Vineyard Sound.	24	80	17	1828
TARPAULIN COVE. One bright fixed light.	W. side of Cove.	25	80	17	1817 1830
VINEYARD SOUND LT.-VES. Two bright fixed lights.	Sow and Pigs Rocks.	40 50			1847
CUTTERHUNK ISLAND. One bright fixed light.	S.W. point of island.	25	[illegible]	15	1823 1843
BIRD ISLAND. One bright revolving light every 3½ minutes.	On the island, E. side of entrance to Sippican Harbour.	25	31	17	1819
NED'S POINT. One bright fixed light.	Near Mattapoisett.	30		13	1837
DUMPLING ROCK. One bright fixed light.	On the rock, in Buzzard's Bay.	26	[illegible]	[illegible]	1828
CLARK'S POINT. One bright fixed light.	W. side of entrance to New Bedford Harbour.	42	52	15	1800 1829
NEWPORT. One bright fixed light.	S. point of Conanicut Island.	64	98	18	1841
GOAT ISLAND, NEWPORT HARBOUR. One bright fixed light.	N. end of island.	20	43	14	1823
NAYOT POINT. One bright fixed light.	On point, Providence River.	23	38		1828 1846

Name and Description of Light.	Situation, &c.	Height of Building.	Height above High Water.	Visible in Miles.	Year erected.
Warwick Neck. One bright fixed light.	S. end of Neck.	30			1826 1846
Poplar Point. One bright fixed light.	Wickford, North Kingston.	24			1831
Dutch Island. One bright fixed light.	S. end of island.	30	56	15	1826
Point Judith. One bright revolving light every 2½ minutes.	On the S.E. point of Naragansett shore.	35	74	17	1810 [illegible]
Block Island. Two bright fixed lights.	N. point of island.	22	58	15	1829 1848
Watch Hill. One bright revolving light every 1½ minutes.	Watch Point, S.E. of Stonington.	35	73	10	1806 1838
Stonington. One bright fixed light.	Eastern side of entrance.	35	62	15	1823 1840
Morgan Point. One bright fixed light.	In Groton, N. side of Fisher's Island Sound.	25		15	1831
North Dumplin Island. One bright fixed light.	On island.	26			1848
New London. One bright fixed light.	W. side of entrance to River Thames.	80	111	[illegible]	1800 [illegible]
Bartlett's Reef Light-Vessel. One bright fixed light.	On reef.				1835
Lynde Point. One bright fixed light.	W. side of mouth of the Connecticut River.	65	74	14	1803 1839
Faulkner Island. One bright fixed light.	On the island.	40	93	16	1801 1840
Five Mile Point One bright fixed light.	E. side of entrance of New Haven Harbour.	65	85	18	1805 1847
Stratford Point. One bright revolving light every 2½ minutes.	On point.	28	44	14	1821
Stratford Point Lt.-Ves. Two bright lights.	On Middle Ground.				1837
Fairweather Island. One bright fixed light.	Entrance of Black Rock Harbour.	40		14	1808 1830
Norwalk Island. One bright revolving light every 2½ minutes.	Entrance of river.	30	40	14	1826
Great Captain Island. One bright fixed light.	On the island.	[illegible]	62	10	1829
Execution Rocks. One *red* fixed light.	Off Sand's Point.	41	54		1848
Throg's Neck. One bright fixed light.	S.E. point of Neck.	40			1826
Sand's Point. One bright fixed light.	On point, Long Island.	40		15	1809
Eaton's Neck. One bright fixed light.	On entrance to Huntington Bay, Long Island.	50	134	19	1798
Old Field Point. One bright fixed light.	On point, Long Island.	30	67	15	1823 1839
Plumb Island. One bright light.	On the island.	30	63	16	1827
Little Gull Island. One bright fixed light.	On the island.	53		15	1806 1837
Cedar Island. One bright fixed light.	Sag Harbour, Long Island.	32	32		1839
Montauk. One bright fixed light.	E. end of Long Island.	80	[illegible]	20	1795

Name and Description of Light.	Situation, &c.	Height of Building	Height above High Water	Visible in Miles	Year erected.
FIRE ISLAND INLET. One bright revolving light every 1½ minutes.	E. side of inlet, Long Island.	74	89	[illegible]	1826 1842
SANDY HOOK LIGHT-VES. Two bright fixed lights.	Seventeen miles outside the Hook.		60 50		1823
PRINCE'S BAY. One bright fixed light.	Near S.E. end of Staten Island.	30	106	19	1828 1842
FORT TOMPKINS. One bright fixed light.	Staten Island, W. side.	40	89	18	1828 1843
ROBBIN'S REEF. One bright fixed light.	Opposite upper end of Staten Island.	48	60	16	1839
SANDY HOOK. One brilliant fixed light. Two bright fixed beacon lts.	On the Hook, southern entrance to New York Harbour.	77 35	90	22 18	1842
POT COVE ROCK LT.-VES. One *red* light.	Moored on the rock; painted red.				1851
NEVERSINK, HIGHLANDS OF One bright fixed light. One bright revolving light every 2½ minutes.	S. of Sandy Hook.	40	248	30	[illegible]
BARNEGAT SHOALS. One bright fixed light.	S. side of Barnegat Inlet.	40		14	[illegible]
TUCKER'S BEACH. One *red* fixed light.	On the beach.	40			1848
CAPE MAY. One bt. rev. lt. every min.	S.W. point of cape.	74	88	17	18.3 1847
EGG ISLAND. One bright fixed light.	On the island.	[illegible]	42		1837
COHANZEY CREEK. One bright fixed light.	W. side of Creek.	40	42		1838
CHRISTIANA RIVER. One bright fixed light.	Entrance of river.				1835
REEDY ISLAND. One bright fixed light.	On the island.	30			1839
BOMBAY HOOK. One bright fixed light.	N.W. end of.	40	46		1831
MAHON'S DITCH. One bright fixed light.	At ditch.	24			[illegible]
MIDDLE SHOAL LIGHT-VES. One bright fixed light.	N.W. of Brandywine Shoal.	45			1823
MISPILLION CREEK. One bright fixed light.	Entrance of creek.	31			1831 1843
BRANDYWINE SHOAL LT.-V. Two bright lights.	Moored on the shoal.		45 42		1823
BREAKWATER. One *red* fixed light.	On Delaware.		56		1849
CAPE HENLOPEN. One bright fixed light. One bright fixed beacon lt.	On the cape.	[illegible] 30	180	27	1840 1825
CAPE MAY LIGHT-VESSEL. Two bright fixed lights.	On Five Fathom Bank.	45 40			[illegible]
SMITH'S ISLAND. One bright fixed light.	On island, in Chesapeake Bay.	24		15	1827
CLAY ISLAND. One bright fixed light.	Entrance of Nanticoke River.	24	36	12	1832
HOOPER'S STRAITS LT.-VES. One bright fixed light.	Southward of Hooper's Island.				1827 1845
SHARP ISLAND. One bright fixed light.	Off entrance of Choptank River.	30		12	1838
TURKEY POINT. One bright fixed light.	At the entrance of Elk River.	30		15	1833

Name and Description of Light.	Situation, &c.	Height of Building	Height above High Water.	Visible in Miles	Year erected.
CONCORD POINT. One bright fixed light.	On point, at the entrance of Susquehannah River.	30		14	1827
POOL ISLAND. One bright fixed light.	On island, in Chesapeake Bay	30		15	1825
NORTH POINT. Two bright fixed lights.	N. side of entrance of Patapsco River.	35 27		15	1824 1843
LAZARETTO POINT. One bright fixed light.	N. side of entrance to Baltimore Harbour.	30		15	1831 1845
BODKIN ISLAND. One bright fixed light.	On island, near the entrance of Patapsco River.	30		18	1822 1845
GREENBURY POINT One bright fixed light.	N. side of entrance to Baltimore Harbour.	21	31	12	1848
THOMAS POINT. One bright fixed light.	S. of entrance to Annapolis.	30		18	1825 1843
COVE POINT. One bright fixed light.	N. of entrance to Patuxent River.	40	50	15	1828 1844
LOOKOUT POINT. One bright fixed light.	N. side of the entrance of Potomac River.	34		15	1830
PINEY POINT. One bright fixed light.	E. side of Potomac River.	25			1836
ASSATEAGUE ISLAND. One bright fixed light.	On the island, between the Chesapeake and Delaware Bays.	45		14	1833
SMITH'S ISLAND. One bright light.	N. end of the island, N. entrance to the Chesapeake River.	55		20	1827 1848
LITTLE WATT'S ISLAND. One bright fixed light.	On the island.	40		15	1833
UPPER CEDAR POINT LIGHT-VESSEL. One bright fixed light.	Off point, below the Narrows.		34		1821
LOWER CEDAR POINT LIGHT-VESSEL. One bright fixed light.	Between Potomac and Yates Point.		33		1837
SMITH'S POINT. One bright fixed light.	Smith's Point, near S. side of the entrance to Potomac River.	65	85	10	1802 1828
SMITH'S POINT LIGHT-VES. One bright fixed light.	S E. of said point.		39 34		1821
WINDMILL POINT LT.-VES One bright fixed light.	N. side of Rappahannock River.				1834
BOWLER ROCK LIGHT-VES. One bright fixed light.	In Rappahannock River.				1835
WOLFTRAP SHOALS LT.-VES. Two bright lights.	Between the York and Rappahannock Rivers.		38 30		1821
NEW POINT COMFORT. One bright fixed light.	On the point.	50		15	1804 1841
BACK RIVER POINT. One bright revolving light.	S. side of entrance to Back River.	30	40	14	1829
OLD POINT COMFORT. One bright fixed light.	Entrance of James River.	40		14	1802 1841
WILLOUGHBY SPIT LT.-VES Two bright lights vertical	S. side of entrance to Hampton Roads.		41 32		1821
CRANEY ISLAND LT.-VES One bright fixed light.	W. side of entrance to Elizabeth River.		53		1820
CAPE HENRY. One bright fixed light.	S. side of entrance to Chesapeake Bay.	72	120	24	1791 1841
WADE POINT SHOAL LIGHT VESSEL. One bright fixed light.	On shoal, in Albemarle Sound.		39		1826
MOUTH OF ROANOKE RIVER One bright fixed light.	Near its entrance.		43	15	1835
ROANOKE ISLAND LT.-VES. One bright fixed light.	Between Pamtico and Albemarle Sound.		38		1835

Name and Description of Light.	Situation, &c.	Height of Building.	Height above High Water	Visible in Miles	Year erected.
LongShoalLight-Vessel. One bright fixed light.	In Pamtico Sound, E. point of shoal.		40		1825
Nine FeetShoal Lt.-Ves. One bright fixed light.	N E. side of Royal Shoal.		40		1827
Royal Shoal Lt.-Vessel. One bright fixed light.	On S.W. point of said shoal.		40		1826
Brant Island Shoal Light-Vessel. One bright fixed light.	On point of shoal.		40		1831
Pamtico Point One bright fixed light.	S. side of Pamtico River.	30	30	13	1828
Mouth of Neuse River. One bright fixed light.	Off March Point.		40		1828
Harbour IslandLt.-Ves. One bright fixed light.	On bar of island between Pantico and Core Sound.		40		1836
Boddy Island. One bright revolving light.	On the island, 32 miles N. of Cape Hatteras.	55	56		1847
Cape Hatteras One bright fixed light.	On the cape	90	95	20	1798 1845
Ocracoke. One bt. rev. lt. every 2 min.	W. end of Ocracoke Island.	65	75	18	1823
Cape Lookout. One bright fixed light.	On the cape.	[illegible]	95	18	1812 1848
Federal Point. One bright fixed light.	N. side of Inlet to Cape Fear River.	40		15	1816 1838
Baldhead. One bright fixed light.	E. side of Entrance to Cape Fear River.	90	110	18	1818 1838
North Island. One bright fixed light.	S. end of North Island.	72	89	15	1801 1845
Racoon Cay. One bright fixed light.	On Cape Roman.	65	87	18	1827 1847
Sullivan Island. Two bright fixed lights.	On the island to guide over Charleston Bar.				1848
Morris Island. Two bright fixed lights.	On the island.		70 40		1837 1845
Charleston. One bright revolving light. Two fixed beacon lights.	On Lighthouse Island, entrance of Charleston Harbour.	102	125	24	1842
St. Helena Bar Lt.-Ves. One bright fixed light.	On the bar.				1836
Martin's IndustryLight-Vessel. One bright fixed light.	Fifteen miles eastward of Tybee light.		40		1839
Tybee. One bright fixed light. One bright beacon light.	N.E. end of Tybee Island.	95	100	22 15	1822 1840
Fig Island. One *red* fixed light.	On E. end of island, in Savannah River.	23			1848
Sapelo Island. One bright revolving light three times in 5 min.	S. end of island.	65	74	17	1820
Wolf Island. Two bright beacon lights.	E. side, near N. end of Wolf Island.	25 15	25	12	1822 1841
St. Simon Island. One bright fixed light.	S. end of island.	75	80	12	1811 1847
Little Cumberland Island. One bright fixed light.	S. side of entrance to St. Andrew Sound.	63		15	1838
Amelia Island. One bright revolving light every 1½ minutes.	N. end of island.	60		15	1838

Name and Description of Light.	Situation, &c.	Height of Building.	Height above High Water.	Visible in Miles.	Year erected.
ST. JOHN'S RIVER. One bright fixed light.	S. side of entrance.	65	65	16	1829 1834
ST. AUGUSTINE. One bright fixed light.	N. end of Anastasia Island, and S. entrance to St. Augustine.	40	70	16	1823
CAPE CANAVERAL. One bright revolving light.	On the cape.	55		16	1847
CAPE FLORIDA. One bright fixed light.	On Cay Biscayne.	65	70	16	1825 1846
CARYSFORT REEF LT-VES. Two bright fixed lights.	Within the reef, in 4 fathoms.		40 30	12	1826
CARYSFORT REEF. Building.					1850
CAY WEST ISLAND. One bright fixed light.	South-western point of island.	49	67	17	1825 1847
CAY WEST LIGHT-VESSEL. One bright fixed light.	About 3 leagues from Cay West.				1848
SAND CAY.	S.W., about 3 leagues from Cay West.	65	100	18	1826 1851
CAY WEST LIGHT-VESSEL. One bright fixed light.	N.W. passage, 12 miles from Cay.		50	18 12	1847 1838
DRY TORTUGAS. One bright fixed light.	Bush Island.	65	70	16	1825 1840
EGMONT CAY. One bright fixed light.	On the Cay, in the entrance of Tampa Bay.	40	80		1848
ST. MARK'S HARBOUR. One bright fixed light.	Point Casinas, E. side of entrance.		73	16	1829 1844
DOG ISLAND. One bright revolving light every 3 minutes.	W. end of island, E. side of middle entrance to St. George Sound. (Destroyed by a gale, January 1, 1852.)	[illegible]		15	1838 1843
CAPE ST. GEORGE. One bright fixed light.	On the cape. (Destroyed as above.)	65	75	15	1847
CAPE ST. BLAS. One bright revolving light.	On the cape, 2 miles from its S. point. (Destroyed as above.)	65	75	15	[illegible]
PENSACOLA. One bright revolving light every 70 seconds.	N.W. of fort, on St. Rosa Island.	40	60	17	1824 1847
MOBILE POINT. One bright revolving light every minute.	E. side of entrance to Mobile Bay.	40	55	16	1821 1835
CHOCTAW POINT. One bright fixed light.	A little S. of Mobile.	40		14	1831
SAND or LIT. PELICAN IS. One bright fixed light.	Three miles S.S.W. of Mobile Point.	50		15	1838
ROUND ISLAND. One bright fixed light.	On island, off Pasca	40	44	14	1833
CHANDELEUR ISLANDS. One bright fixed light.	On the N. end of islands.	55		14	1848
BILOXI. One bright fixed light.	In village, western entrance to Bay.	45	53	14	1848
CAT ISLAND. One bright fixed light.	On western point.	45		14	1831
PASS CHRISTIAN. One bright fixed light.	N.W. of Cat Island, 6½ miles.	30		13	1831
MERRILL SHELL BANK LIGHT-VESSEL. One bright fixed light.	On bank.				1847
MISSISSIPPI RIVER.					
FRANK ISLAND. One bright fixed light.	Mouth of Mississippi River, N.E. pass, N. side.	65	78	21	1820
SOUTH POINT. One bright revolving light.	S. pass, S.W. side, striped black and white horizontally.	65		21	1831 1848

N

Name and Description of Light.	Situation, &c.	Height of Building.	Height above High Water.	Visible in Miles.	Year erected.
South-West Pass of Mississippi River. Two bright fixed lights.	S.W. pass, W. side, striped black and white perpendicularly.	65		17	1831 1840
Point De Fer. One bright fixed light.	At the entrance of the River Teche.	65	70	17	1826
Point De Fer Lt.-Vessel. One bright fixed light.	Twelve miles westward of the point.				
Vermillion Bay. One bright revolving light.	On W. end of Marsh, or Belle Island.	54	90	16	1839
Galveston Bay.	Building on E. side, on Bolivar Point.				1850
Galveston Bay Lt.-Ves. One bright fixed light.	Within the bar.				1849

14. THE BERMUDA ISLANDS.

POSITIONS OF PLACES.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Ireland Island; Flagstaff [1]	32 19 30	64 51 40	The Trigonometrical Survey, by Captain Thomas Hurd, R.N., under the orders of the British Admiralty, between the years 1783 and 1797, adjusted by the observations of Captain Edward Barnett, R.N., 1846.
Wreck Hill ....[2]	32 16 45	64 54 40	
Gibb's Hill Lighthouse, light revolving every minute, (362 feet) ....[3]	32 15 4	64 51 36	
Mount Langton; Signal Station North of the Town of Hamilton	32 18 30	64 48 12	
Castle Island; entrance of Castle Harbour	32 21 0	64 40 30	
St. David's Head	32 22 50	64 38 45	
Fort Cunningham; at the Entrance of St. George's Harbour........................	32 23 13	64 39 37	
Mill's Breaker; Eastern Extremity of the Reef	32 23 48	64 41 0	
North Rock; Northern limit of Reef	32 30 30	64 46 55	
Long Bar, N.W. end; the Western Extremity of the surrounding Reef	32 16 40	65 2 20	
S.W. Breaker; Southern Extremity of the Reef	32 13 30	64 53 30	

NOTES.

1. Between the years 1783 and 1797, Captain T. Hurd, R.N., was employed in the survey of these beautiful islands, the outline of which survey is published by the British Admiralty. Captain Hurd deduced his longitudes from Wreck Hill, which, from its position, as recently ascertained, may be taken as 4′ or 5′ East of the correct longitude. In the chart of the Bermuda Islands, as published by Mr. Laurie, we have placed the islands in the longitudes which, from the accuracy of Captain Barnett's observations, we may suppose to be finally settled.

Ireland Island.—The position of Bastion C, which serves as a groundwork for the rest, was determined by meridian latitudes; and the longitude, we presume, is by

chronometer, from the West Indies. The detail of these operations is given by Captain Edward Barnett, R.N., in the *Bermuda Royal Gazette*, August 25th, 1826.

2. WRECK HILL.—As we have mentioned, Captain Hurd considered this to be in lat. 32° 15′ 20″, and lon. 64° 50′; but, according to the corrected position of Ireland Island flagstaff, this is 1′ 25″ South, and 4′ 40″ East, of its right place.

3. GIBB'S HILL LIGHTHOUSE.—The position of this was obtained by triangulation from Ireland Island; but on applying these calculations to Captain Hurd's survey, we find some small discrepancies; but as they are not of sufficient magnitude to affect navigation, we have not attempted to adjust them.

The lighthouse is an important structure, composed of iron, constructed in London, from the designs of Mr. Alexander Gordon, C.E., and erected under the superintendence of Mr. George Grove, in 1845. Its total height is 133 ft. 9 in., and the light was first shown May 1st, 1846. The tower is painted white, and in the day time will appear like a sail. The light revolves, and shows a bright glare every minute, but a fainter continuous light is visible within 15 or 20 miles off. It is 362 feet above the sea, and may be seen from a frigate's deck 7 or 8 leagues, but has been seen quite bright at 33 miles off. The light apparatus is dioptric, or from lenses (1 d, see pages 14 and 16). The light is intercepted between *N.* 43° 24′ *E., true*, or N.E. ¼ E. by compass, and *N.* 47° 34′ *E., true*, or N.E. ¾ E., mag., by the hills at St. George's; and also between *N.* 49° 7′ *E., true*, N.E. by E. mag., and *N.* 57° 35′ *E., true*, N.E. by E. ¾ E., mag., by the hills on the South side of the island.

Variation, 7° 1′ W.—October, 1845.

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15. THE BAHAMA AND PASSAGE ISLANDS.

POSITIONS OF PLACES.

	LAT. N.			LON. W.			AUTHORITIES.
	°	′	″	°	′	″	
LITTLE BAHAMA BANK.							
MATERNILLO BANK; N.W.							
End of ....[1]	27	25	0	79	8	0	Captain Edward Barnett, R.N., 1846.
Maternillo Shoal, 12 feet	27	22	0	79	4	0	
Outer Part of the Western Reef	27	5	0	79	12	0	The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish Surveying Officers, &c., with subsequent corrections.
Memory Rock	26	54	30	79	2	20	
West End of Grand Bahama I.	26	41	0	79	3	0	
S.E. Point of Grand Bahama	26	28	0	78	40	0	
HOLE IN THE ROCK or WALL;							
Lighthouse ....[2]	25	51	30	77	7	45	
N.E. Point of Abaco (*so called*)	26	30	0	76	57	0	
Elbow Reef; Outer Point ...	26	33	0	76	50	0	
GREAT BAHAMA BANK.							
THE SOUTHERN KAYS:							
The Brothers; Eastern Rock	22	1	30	75	41	0	The Observations of Captain Richard Owen, R.N., 1831-32.
THE JUMENTOS, or Yumentos:							
Little Ragged Isle; Beacon	22	9	30	75	41	30	
Ragged Island; Flagstaff...	22	11	40	75	44	17	
Racoon Kay; Beacon	22	21	50	75	49	39	
Channel Kay..................	22	32	15	75	52	50	
Jamaica South Kay	22	42	56	75	54	46	REMARKS.
Man of War Kay; N. End	22	47	20	75	54	0	A description of, and directions for, these isles and passages, according with the New Surveys, are given in the copious *Notes* prefixed to the second volume of the *Colombian Navigator*, edition of 1848, pages 212, 213.
Flamingo Kay; Hill.........	22	52	0	75	53	6	
Water Kay; S.W. Point ...	22	58	0	75	45	3	
YUMA or LONG ISLAND:							
South Point of the Isle......	22	50	0	74	52	0	
Great Harbour; Entrance...	23	7	0	74	52	30	
Michael Bank; 12 fathoms	23	9	15	74	45	30	

THE BAHAMA AND PASSAGE ISLANDS—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
YUMA or LONG IS.—*contin.*			
North end of the Isle	23 41 37	75 19 0	The Observations of Captain Richard Owen, R.N., 1831-32.
EXUMA; the Beacon	23 32 30	75 46 0	
Galliot Cut, on the Bank......	23 55 0	76 15 0	
Eleuthera; S.E. Point	24 37 0	76 9 23	
———; Governor's Harb.	25 11 15	76 14 53	
———; James' Cistern .	25 21 0	76 23 0	
———; Harbour Island. .	25 30 0	76 39 0	
———; Egg Island Reef; Extremity.................. [3]	25 34 0	76 55 30	The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish Officers, &c.; with the subsequent corrections of Captain Richard Owen, Captain E. Barnett, Lieutenant T. Smith, &c., 1836—1842.
THE ISLES, &c., on the N W.:			
Fleeming Channel; Beacon	25 16 45	76 55 3	
Douglas Channel; Entrance	25 7 30	77 2 45	
NASSAU, New Providence; *Lighthouse* .... [4]	25 5 10	77 21 4	
Joulter Kays; North Extremity	25 19 30	78 8 [illegible]	
ANDROS ISLES: Morgan's Bluff, or N.E. Point......	25 10 24	78 1 30	
High Kay, on the East Coast	24 39 30	77 42 50	
Golding Kay	24 13 40	77 37 20	
Green Kay, in the Gulf ...	24 2 12	77 10 0	
Berry Isles:			
S. Stirrup Kay; N.W. Point	25 25 5	77 56 13	
Gt. Stirrup Kay; East Point	25 49 40	77 53 45	
Holmes' Kay; Centre	25 37 40	77 44 0	
Great Isaac; Centre ...... [5]	26 2 0	79 6 20	
Western Side of the Great Bank:			
Moselle Reef; Bemini Isles	25 29 10	79 17 30	
Gun Kay: Lighthouse [6]	25 34 35	79 18 24	
Brown's Kay	25 23 40	79 13 0	
South Riding Rock	25 14 0	79 10 0	
Orange Kays; Middle......	24 56 30	79 9 24	
Southern Part of the Bank:			
Guincho, or Ginger Kay ...	22 47 0	77 59 0	
Lobos, or Wolf Kay	22 23 0	77 34 0	
Mucaras, or Diamond Pt. [7]	22 10 0	77 18 0	
Cayo Verde, or Green Kay	22 1 0	75 10 0	
Kay of St. Domingo ... [8]	21 42 0	75 [illegible] [illegible]	
The PASSAGE ISLANDS:			
Little St. Salvador; West Point	24 36 22	75 58 0	
St. Salvador; Columbus or S.E. Point	24 8 30	75 16 48	
Hawk's Nest, or S.W Point..	24 8 50	75 32 30	
N W Point	24 41 10	75 45 30	
Conception Island; South End	23 48 46	75 6 0	
Southampton Reef, Extremity	23 55 15	75 7 3	
Rum Kay; S.E. White Cliffs	23 38 40	74 47 20	
———; West End ... [9]	23 39 0	74 56 35	
Watling's Island; large White Rock at the North End...	24 10 15	74 28 30	
The S.W Point................	23 56 27	74 34 0	
Hinchinbroke Rock	23 56 40	74 28 33	
Samana or Attwood Kays:			
East Low Kay	23 5 0	73 36 48	

THE BAHAMA AND PASSAGE ISLANDS—continued.

	LAT. N. ° ′ ″	LON. W. ° ′ ″
Samana or Attwood Kays—*cont.*		
Westernmost Reef; Extremity	23 5 50	73 52 0
Southern Reef	23 4 45	73 45 0
Planas, or Flat Kays; Centre	22 35 10	73 33 0
Crooked Islands, &c.:		
The N.E. Breaker	22 43 30	73 47 0
N.E. Reef; Extremity	22 47 0	73 49 45
Mount Pisgah	22 44 10	74 7 33
Bird Rock, off N.W. Point	22 51 0	74 22 15
Fortune Isle, or Long Kay; South Point	22 32 0	74 23 0
Castle Isle ....[10]	22 7 0	74 18 45
Miraporvos: *		
North Rock	22 7 50	74 32 40
South Kay; Sand-hills	22 5 0	74 32 15
Shoal; S.E. End	21 58 30	74 27 30
Diana or Monkey Bank; Centre	22 31 0	74 47 30
Mariguana, or Mayaguana; S.W. Point	22 21 45	73 9 30
Eastern End of East Reef	22 18 0	72 38 16
The Caycos		
Cape Comet, N.E. Point [11]	21 42 50	71 27 38
Large House, near the Booby Rocks	21 49 0	71 41 0
The Three Maries	21 57 30	72 2 30
West Caycos; South End	21 37 30	71 44 33
Providenciales; N.W. Point	21 52 40	72 20 3
West or Little Cayco South Point	21 37 30	72 28 33
West Sand Spit	21 22 0	72 5 0
South Shoal	21 2 0	71 44 33
Swimmer Shoal	21 5 15	71 29 0
The Hogsties N.W. Kay	21 41 30	73 50 0
Great Inagua		
The N.W. point ....[12]	21 7 30	73 39 30
Middle Point	21 1 45	73 41 0
S W Point	20 55 0	73 39 3
Lantern Head (62 *feet high*)	20 56 30	73 19 24
S.E. Point	20 57 45	73 9 48
N.E. Point	21 20 30	72 59 30
Little Inagua; East Point	21 29 15	72 55 33
———; N.W. Point	21 30 40	73 4 33
Turks' Islands:		
Endymion Reef	21 7 15	71 18 18
Sand Kay; Centre	21 11 12	71 14 33
Salt Kay; Centre	21 20 0	71 12 0
Grand Kay; Roadstead [13]	21 28 10	71 7 30
Square Handkerchief; N.E. detached Breaker	21 6 30	70 27 20
S E. Extremity	10 47 30	70 27 0
Western Extremity	20 56 0	70 57 0
Augusta Reef?	20 37 30	70 13 0
Silver Kay or Plate Bank:		
East End (10 *fathoms*)	20 35 20	69 21 53
S.E. Point	20 13 0	69 35 48

AUTHORITIES.

* The Miraporvos Bank and Kays were surveyed by Mr. De Mayne, in 1827. The bank is 11½ miles in extent from S.S.E. to N.N.W., and the shoals upon it are very dangerous, particularly to those advancing from the S.E. With the wind blowing strong from the northward they break heavily, and at all times there is a heavy swell upon them. The current generally sets from the N.E. over the shoals, at the rate of 1 mile an hour.

The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish Officers, &c. with the subsequent corrections of Captain Richard Owen, &c.

Remarks.

Turks' Island Passage.—Near the S.E. end or Elbow of the Caycos Bank, is a shoal, in lat. 21° 4′, lon. 71° 31′ 32″, having over it, in some parts, only 5 feet of water, and lying with a bushy kay on the bank bearing N by W. (by compass) 6 or 7 miles. Lat. by merid. alt.: lon. by two good chronometers, made by Barraud: one giving 71° 31′ 5″; the other, 71° 32′ 0″—(*Edw. Dunsterville, H.M.S. Carnation.*)

THE BAHAMA AND PASSAGE ISLANDS—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
SILVER KAY BANK—*cont.*			
N.W. Point	20 55 0	69 56 13	The Surveys of Mr. Anthony De Mayne, &c.
S.W. Point ....[14]	20 17 20	70 0 53	
BAJO de NAVIDAD, or Ship Bank:			
Northern Extremity ...[15]	20 14 0	68 51 18	
Eastern	20 2 0	68 47 33	
South-West	19 51 50	68 58 16	

NOTES.

1. MATERNILLO BANK and REEF.—The Maternillo Bank, to the northward of the reef, is not represented in Mr. De Mayne's Chart, although given in that of the Spanish Surveyors. It has been examined by Captain Edw. Barnett, R.N., in 1846, and the positions corrected accordingly.—See, further, *Colombian Navigator*, 1848, vol. ii. p. 203.

2. ABACO LIGHTHOUSE.—Of the light-tower near the South end of Abaco, or '*Hole in the Wall*,' the base is 80 feet above high water, and the tower is 80 feet high. The light revolves once in every minute, and may be seen in all directions, except where the high parts of the land intervene; and being 160 feet above the level of the sea, it will be visible, in clear weather, at the distance of 15 miles to an eye elevated 10 feet; 17 miles to one elevated 20 feet; 19 miles from 40 feet; and 21 miles from 80 feet.

During ordinary winds there is good anchorage in 10 and 11 fathoms, with the lighthouse bearing E. by N. about half a mile from shore. The edge of the bank, to the eastward of the lighthouse, is nearly 1¼ miles from shore, with 23 to 16 fathoms, extending out to the S.S.E. in a tongue of soundings, with quite clear ground.—*Colombian Navigator*, vol. ii. pp. 199, 201.

3. EGG ISLAND REEF.—The *Lorton Rock*, described in the *Colombian Navigator*, vol. ii. p. 162, *does not exist!* Captain Richard Owen has shown that the vessel really struck on *Egg Island Reef*, just to the northward of Royal Island, and not more than a mile from Gaulding Kay.—For particulars, see *Colombian Navigator*, vol. ii. p. 209.

4. NASSAU.—The position appears to be finally settled, as in the Table. The Spanish Surveyors gave the town as in 25° 4′ 33″ N., and 77° 19′ 30″ W. Mr. De Mayne as 25° 5′ 18″ N., and 77° 19′ W. The lighthouse, showing a harbour light, since improved, and similar to that on Abaco, is 70 feet above the level of the sea; it is on the West end of Hog Island, and therefore to be left on the larboard or North side, when entering into the harbour.

5. GREAT ISAAC.—This islet is described in the *Colombian Navigator*, vol. ii. p. 217, but it may not be amiss to notice that it is moderately high, has several wells of fresh water, and abundance of large shell-fish. The Providence droggers water here.

6. GUN KAY.—The important lighthouse on this kay shows a brilliant revolving light every minute all round the compass, at an elevation of 80 feet, visible 12 to 15 miles off.

7. DIAMOND POINT of the MUCARAS.—The Mucaras, Lavanderas, and Lobos, with the dangers on the bank in the vicinity, have lately been surveyed, with great care, by Captain *Edward Barnett*, whose positions are those given in the Table. This portion of the bank was formerly represented, as in the Spanish Charts, rather more to the South, and 6′ more to the East.

8. KAY of ST. DOMINGO.—The southern part of the Greak Bank, on which this kay is situate, is very dangerous by night. The kay had formerly the appearance of a sail, but, in 1835, the crew of the *Thunder* erected a beacon of stones, about 15 feet high, upon the centre of it; the other part of the kay is about 5 feet only above water. It is a rocky, arid spot, producing nothing but a little samphire and wild grass.—*Colombian Navigator*, vol. ii. p. 214.

9. RUM KAY.—This island has been very erroneously represented on the charts, both

as to magnitude and position. The white cliffs at the S.E. end are remarkable, and may be seen 6 leagues off.—See *Colombian Navigator*, vol. ii. p. 228.

10. Castle Isle.—The point appears to be finally settled. Former observations gave 22° 7′ 45″ N., and 74° 17′ 30″ W. Mr. De Mayne as in the Table.

11. Caycos.—Captain Livingston's Remarks on the Northern Reefs of the Caycos, and the danger of approaching them without great caution, may be found in the *Colombian Navigator*, vol. ii. p. 245. Captain Livingston says—"I am perfectly satisfied that any vessel shaping a course from off the rocks, to weather the N.W. point of the Caycos by any chart hitherto published, will infallibly get entangled among the reefs on the West side of the Watering Bay. When a vessel once gets embayed among them, it must be next to impossible to beat out; as the reefs extending from the land to the eastward hook suddenly round, at their outer extremity, to the southward. Thus a vessel may be in blue and deep water while the hook of the reef is outside her. I have three times examined the appearance of these reefs from the mast-heads of different vessels, and each time they appeared to me more dangerous than they had previously done."—(*This was written in* 1818.)

In the Caycos Passage it has been reported that a rock exists. A communication in the *Nautical Magazine* gives the particulars: it is stated to be in lat. 35° 25′, lon. 49° 1′. The sea did not break over the patches.

12. Great Inagua.—On the S.E. coast of Inagua are several detached coral reefs about, and at some distance from, the S.E. point. On one of these H.M.S. *Statira* was lost; and on another, if not the same, the bark *Emerald*, Captain Nockells, struck, at five p.m., 11th June, 1834, on her passage from Jamaica to London. The bark was on it for two hours, while the small islet off the S.E. point bore West, distant 4 miles, and the nearest shore was 5 miles off. The depth of water was about 18 feet. The captain observes that, as broken reefs may extend a long way out, vessels in passing should not advance within 10 miles of the shore. The *Emerald* was so much damaged that it became necessary to abandon her; and on the next day, at seven p.m., her crew were saved in a Spanish schooner, bound for Philadelphia, being then, with 9 feet of water in her hold, in lat. 20° 36′, lon. 73° 10′, 24 miles to the southward of Inagua.

13. Grand Turk.—A lighthouse on the N.E. point. This and the other lights about the island have been discontinued (April, 1842).

14. Silver Kay Bank.—It seems that the *Fletcher Reef*, said to have been discovered near the S.W. extremity of the *Silver Kay Bank*, in 1833, really exists on the S.W. part of that bank, the true form of which has, for the first time, been ascertained by Captain Owen and assisting officers, as now exhibited on the charts. Its N.E. side is extremely dangerous, having a cluster of rocky heads, extending 18 miles, and even with the water. There are also detached patches on the North and north-western parts.

15. The Bajo de Navidad has been described as a fine clear bank of an oval form: its greatest length 23 miles North and South, and 11 in breadth: the least water on it 11 fathoms, which is on the S.E. edge. The general depths 16 and 17 fathoms, very even bottom, coral and sand: the water being of a darkish hue, the bank is not easily distinguished.

VARIATIONS of the COMPASS.—The present variation at the head of the Maternillo Bank is nearly 5° E. At Nassau, in Providence Island, it was found, in 1836, to be 3¼° E. At Gun Kay, on the western side of the Great Bank, 4° 30′ E.: at the Jumentos and Eleuthera, 4°: at the crooked Islands and Watling's Island, nearly the same: at the Caycos it was 3° 10′; and at Turks' Islands 2° 54′, 1836.

16. CUBA, JAMAICA, ETC.

POSITIONS OF PLACES.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
S.E. and East of Cuba.			
Cape de Cruz	19 50 11	77 45 15	Spanish Surveyors, &c.

CUBA, JAMAICA, ETC.—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″
Peak of Tarquino............[1]	20 3 0	76 51 0
St. Iago de Cuba, Morro at the entrance; *Lighthouse* [2]	19 57 29	76 10 45
Port Guantanamo; Entrance	19 55 10	75 20 25
—— Escondido; East Point	19 55 30	75 12 20
—— **Baitiqueri; Entrance**	20 1 0	75 1 10
Cape Maysi, or Maize ..[3]	20 14 0	74 7 37
Port Mata; Entrance	20 17 20	74 31 41
—— Baracoa, Entrance...[4]	20 21 36	74 29 31
—— **Maravi; Entrance**	20 24 30	74 27 35
—— **Navas; Entrance**	20 29 35	74 29 50
—— Cayaguaneque; E. Point	20 30 30	74 31 0
—— Taco, West Point	20 32 20	74 34 0
—— Jaragua; Entrance	20 32 40	74 36 40
Punta (Point) de Guarico	20 39 0	74 40 45
Port Cayo Moa; Kay, E. Point	20 42 0	74 47 5
—— Yaguaneque; Entrance	20 41 50	74 58 5
—— Cananova; Entrance	20 42 0	75 0 25
—— **Cebollas; Entrance**	20 42 20	75 2 35
—— **Tanamo; Entrance**	20 44 10	75 11 50
—— **Cabonico; Entrance**	20 42 20	75 21 0
—— **Nipe; Entrance**	20 45 40	75 26 0
—— **Banes; S.E. Point**	20 53 30	75 34 0
Punta (Point) de Mulas	21 4 45	75 30 45
Northern Kays and Coast of Cuba.		
S. Domingo; Kay	41 42 0	75 44 45
Lobos or Wolf Kay	22 25 0	77 38 0
Guincho or Ginger Kay	22 47 0	78 3 0
Port Sama; Entrance	21 5 45	75 43 15
—— Naranjo; Entrance	21 5 25	75 49 0
—— Vita; Entrance	21 5 0	75 55 0
—— **Bariay; Entrance**	21 5 0	75 57 0
—— **Jururu; Entrance**	21 5 0	75 58 10
—— **Jibara; Entrance**	21 5 20	76 2 35
—— del Padre Entrance	21 15 45	76 24 37
—— Malagueta Entrance	21 17 0	76 29 28
—— **Manati; Entrance**	21 23 45	76 43 0
—— **Nuevitas Grandes; Entrance**	21 35 40	77 4 45
Punta (Point) **Maternillos** [5]	21 40 0	77 8 0
Cayo Romano; **S.E. Point** [6]	21 51 20	77 35 0
Cayo Verde, or Green Kay	22 7 0	77 36 30
Cayo Confites (*Sugar-Plum Kay*); North Point	22 12 25	77 37 50
Double-Headed Shot; N.W. Kay [7]	23 56 28	80 27 38
Cayo de Sal, or **Salt Kay**	23 39 8	80 16 38
Cayo Cruz del Padre	23 17 20	80 53 15
Matanzas Cast de S. Severino	23 2 48	81 32 40
——; **Pan or Hill**	23 1 39	81 40 20
HAVANA, Morro; *Lighthouse* [8]	23 9 18	82 21 40
Port del Mariel; **Entrance**	23 8 15	82 46 40

AUTHORITIES.

The Officers acting under the orders of the Spanish Government, for the purpose of ascertaining by chronometers, &c., the Positions of all the principal Points in the West Indies, with emendations, by Captain Foster, **Captain R. Owen, &c.**

REMARKS.

We have here given the situation of all the harbours in Cuba, which have been surveyed by the Spanish Officers. The longitudes have been subsequently rectified: those of the North coast are more to the eastward, and agree with the large general Chart of the Bahama Old Channel, published by the Direccion Hidrografica of Madrid, and since in London.

The greater part of the harbours are singularly formed, having a narrow entrance, mostly bordered with a reef or shoal, but opening into a basin inward, which affords shelter from every wind. Of such are, St. Iago, Guantanamo, Escondido, Baitiqueri, Mata, and Baracoa; but the entrance of the latter is bold-to; again, Iaco, Yaguaneque, Cebollas, Tanamo, Cabonico and Livisa, Nipe, Banes, Naranjo, Vita, Jururu, Del Padre, Malagueta, Manati, Nuevitas, Havana, Mariel, Bahia-Honda, and Jagua.

CUBA, JAMAICA, ETC.—continued.

	Lat. N. ° ′ ″	Lon. W. ° ′ ″	Authorities.
Port Cavanas; Entrance	23 2 20	82 58 30	The Spanish Surveyors, &c.
Bahia Honda; Entrance	23 0 45	83 12 30	
Guaijabon; Pan or Hill	22 49 0	83 23 20	
S.W. Coast of Cuba.			
Cape Antonio; *Roncali Lighthouse*..................[9]	21 51 40	84 58 0	Captain R. Owen.
Cape Corrientes ....[9]	21 46 20	84 31 3	
Llana or Mangrove Point......	21 51 20	83 54 0	The Spanish Surveyors, &c., as before.
Cape St. Francis, Isle of Pines	21 37 0	83 12 0	
Bahia de Jagua, or Cienfuegos; *Lighthouse* ....[10]	22 1 10	80 36 35	
Trinidad; City of...........	21 42 0	80 3 25	
Puerto Casilda; Entrance ...	21 38 15	80 2 30	
Cayo Blanco de Saza; West Point	21 22 30	79 42 30	
———; East Point	21 31 20	79 43 35	
Cape Saza de Tierra; East Point	21 31 30	79 40 20	
Cayo Breton; East Point......	21 2 25	79 29 20	
Boca Grande; Entrance	20 58 0	79 23 45	
The Grand Cayman: S.W. Bay, Fort George [11]	19 17 45	81 24 3	Latitude, Captain R. Owen, R.N.; longitude, Commander Barnett.
JAMAICA and Isles Adjacent. [11]			
Morant Kays; N.E. Kay......	17 26 30	75 56 0	The mean of numerous Observations, taking into account those of Messrs. Leard, Robertson, De Mayne, and Dunsterville, of Mr. F. Owen, and Captain Edw. Sabine; adjusted by the meridian of Port Royal Dockyard, as ascertained by Captain Rich. Owen, in 1830.—For particulars, see the *Colombian Navigator*, vol. ii. page xviii., and the Chart of Jamaica, with its Harbours, published by Mr. Laurie.
———; S.W. Kay......	17 23 45	75 58 0	
Morant, or East Point of Jamaica ....[12]	17 56 0	76 11 19	
Yallah's Point	17 51 45	76 36 30	
Plum Point	17 55 15	76 46 55	
Port Royal Dockyard [12]	17 55 51	76 50 45	
Kingston; Church............	17 57 57	76 47 35	
Portland Point	17 43 50	77 7 24	
Portland Rock ....[13]	17 8 30	77 28 0	
Pedro Kays; N.E. Kay...[14]	17 6 0	77 46 0	
Pedro Bluff	17 51 30	77 46 24	
Black River; Entrance	18 1 10	77 53 15	
John's Point	18 11 30	78 17 30	
South Negril	18 15 45	78 25 30	
Montego Bay Point	18 31 30	77 59 0	
Galina Point	18 27 30	76 58 0	
Anotta Bay; the Town.........	18 19 0	76 49 45	
Port Antonio; Navy Island...	18 14 40	76 31 0	
Formigas; N.E. Part	18 34 30	75 41 30	
———; S.E. Part...........	18 27 0	75 42 0	
———; S.W. Part	18 26 0	75 51 30	
Navaza; Centre of the Isle .	18 24 45	75 3 0	
Baxo Nuevo; Sandy Kay [15]	15 53 0	78 38 30	The Survey of Captain Richard Owen, in 1836.
Serranilla; S.W. Kay ...[16]	15 47 45	79 50 43	

NOTES.

1. PEAK of TARQUINO.—We have given the Peak of Tarquino according to Captain Bird Allen, who determined the position of the peak from the ship, by observation during three days' calm, after leaving Port Royal, as lat. 20° 3', lon. 76° 51', or 4¼ minutes beyond that given by the Spanish authorities. The peak is about 5,500 feet high above the level of the sea.

2. ST. IAGO de CUBA.—Mr. Nicholls, Master of the *Sheerwater* brig of war, in 1819, communicated the situation of the Morro Castle of St. Iago, from observations made in that ship, as follows:—Latitude observed, 19° 57' 50": longitude by lunars, 76° 2' 45": by chronometer 76° 0'. The Spanish Chart of the harbour represents the Morro as in 75° 55' 33" W. In the last Chart it is given as 76° 0'. This appears to be too far East: the chronometric difference from Port Royal is 40', which will place it as represented.

A lighthouse has been erected on the table-land, about 300 feet to windward, or East of the Morro, to point out the entrance to the harbour, and prevent vessels running to leeward of it during the night. The light revolves in 2½ minutes at 240 feet, and is visible at 20 or 24 miles.

3. CAPE MAYSI.—Captain Foster places Cape Maize in 74° 5' 18", considering Chagres as 78° 57' 19". Captain Owen makes it 74° 8' 0". It may be observed that Captain Foster's longitudes appear to be about 3 minutes easterly (2' 56"), and this correction applied to his positions will properly adjust them: this will place Cape Maysi in accordance with Captain Owen's determination.

4. PORT BARACOA.—Captain Foster found the difference of longitude between this and Cape Maysi to be 21' 54", which gives the position in the Table. The point of observation is the Fort of Point Barlovento, on the weather point of the harbour.

5. NUEVITAS.—The channel into this harbour is to the S. by E., 4 miles from Point Maternillos. On Point Maternillos a lighthouse to show a revolving light at 176 feet above high water is constructing (1850). It has "Colon" painted on it. Besides this there are lighthouses constructing at the *Cayo Paredon Grande*, *Cayo Lobos*, and *Cayo Confites*.

At CARDENAS BAY, also on the North coast of Cuba, there is a revolving light shown on Piedras Kay (lat. 23° 14', lon. 81° 9'), and a red and white or revolving light on the Cayo de Aña.

6. CAYO ROMANO, &c.—In the year 1781, M. le Marquis de Chabert, when proceeding from St. Domingo to the Chesapeake, had an opportunity of observing, by chronometers, the longitude of Cayo Romano, Port Matanzas, and the Pan of Matanzas; and his results were, for the first, 77° 39' 45" W., and for the last, 81° 36' 30", being, in the mean, only 2 minutes to the westward of the late determinations.

7. DOUBLE-HEADED SHOT.—The position, according to the last edition of the Spanish Chart of the Mexican Sea, &c., edited by the late Admiral Don José de Espinosa, first Director of the Hydrographic Establishment at Madrid, is lat. 23° 26' 28", lon. 80° 21' 0". In the first edition, published (by order of the Minister of Marine, Don Juan de Langara) in 1799, the N.W. Kay was represented in lat. 23° 53', lon. 80° 14'. Mr. De Mayne places the N.W. Kay in 23° 55' N., and 80° 26' W.

This is not the only variation to be found in the different editions of the Spanish Charts, even on points marked as determined; although the observations of the Spanish officers are generally admitted, by those who have given them an examination, to be excellent. It may not be superfluous here to notice, that the eastern extremity of Florida, in lat. 26° 35', appeared in the first edition of these charts in 80° 5¼' W.; but, in the last edition, it is placed in 79° 54¼', or 11' more to the eastward.

On the north-westernmost and highest of the narrow ridge of detached barren rocks, known as the Double-Headed Shot Kays, a lighthouse has been erected by the British government, in lat. 23° 56' 28" N., lon. 80° 27' 38". The light is fixed, and 100 feet above the sea; the tower being 54 feet high, it is visible from 14 to 20 miles, according to the height of the observer, in all directions except S.S.W. ¼ W., where, at 9 miles distant, it will be hidden by Water Kay.

8. HAVANA and LIGHTHOUSE.—The position formerly given was lat. 23° 8' 18" N., lon. 82° 22' 4" W. The longitude being the mean of twenty results, from stars eclipsed by the moon, by Don Josef Joachim de Ferrer, 1808, 9, 10, 11, 12; but a further rectification has given the position shown by our Table. This place, which is taken by *Lieutenant* Raper as a secondary meridian, is considered by him as in lon. 82° 21' 57" W.

The difference, 17″, between this and Mr. Purdy's position, is but trifling, and the latter has been retained.

The *Lighthouse* on the Morro upon the eastern Point of the Harbour, exhibits a brilliant revolving light, which appears in its full lustre once in a minute. Although an inferior light, it may be distinctly seen, in clear weather, between 3½ and 4 leagues off.

Cape Antonio, Isle of Pines, &c.—On the 12th of August, 1817, Captain Livingston came to an anchor off Cape Antonio, in 7 fathoms; and by an excellent observation, found his latitude to be 21° 53′ 54″; this confirms that which has been given by the Spanish officers. The longitude is well established between 84° 57′ and 84° 58′. The Baron von Humboldt gives 84° 57′; Captain Owen, 84° 58′: the Spanish officers had previously given it as 84° 57′ 30″, now confirmed.

A *lighthouse*, called the *Roncali Tower*, and having that word painted on it, 117 feet in height, stands on the cape. It exhibits a brilliant revolving light every minute, at an elevation of 170 feet above high water, and is consequently visible at 14 miles' distance. It was first shown in 1850, and must prove exceedingly serviceable to navigation.

10. Jagua.—A lighthouse, showing a brilliant fixed light at 82 feet above high water, has been built (1850) on the East point of the entrance, Point Colorados. The tower is 45 feet high, and has "Villanueva" painted on it.

11. Grand Cayman.—The latitude of the S.W. kay of the Grand Cayman, as observed by Captain Livingston, August 5th, 1817, appeared to be 19° 14′, not 19° 11′, the parallel formerly assigned: the longitude was communicated to us by the late Captain Hurd, as a determination to be relied on, and it appears to have been confirmed by Captain J. W. Monteath, as shown in the *Colombian Navigator*, vol. ii. p. 93.

The S.E. point, as communicated by Mr. Dunsterville, lies in lat. 19° 16′ N., and lon. 81° 6′ 40″ W. The village on the West, formerly the *Hogsties*, is now called *Georgetown*, but the most populous village is *Boddentown*, on the South.

12. JAMAICA in general.—In his outline of Jamaica, 1821, Mr. De Mayne gives Morant, or the eastern point, in lon. 76° 12′, and South Negril, or the western point, in 78° 25′ W. By reference to the Table it will be seen that we give the one in 76° 11′ 19″, and the other in 78° 25′ 30.

Mr. Leard, in his Survey of 1791, gave Morant Point in 76° 3′, and South Negril in 71° 33′; consequently he represented the island more than 15′ longer than it has been since exhibited; and there is reason for believing that the length is rather less than greater than that which we have given. The northern coast, it also appears, has been placed too far North from 1 to 2 miles. We have attempted to adjust these differences, still adhering to the *safe side*, on the New Chart of Jamaica and its Harbours, published by Mr. Laurie; and we give, with confidence, from several communications, Point Morant more, and South Negril less, to the West, than as shown on former charts.—See, farther, the Note on Port Royal and Kingston, in vol. ii. of the *Colombian Navigator*.

It may here be remarked, that Lieutenant Raper assumed Port Royal as 76° 50′ 54″, but considered that it was not satisfactorily settled. From subsequent calculations from data supplied by Commander Barnett's chronometric differences, he has arrived at the conclusion that it is 76° 51′ 47″, or 1′ more than his former longitude, or than that given in our Table; we have still adhered to the safe side.

Morant Point Lighthouse.—On November 1st, 1842, a bright light, revolving once in every minute, has been shown from an iron light-tower on this point, at 103 feet above the level of the sea, and can be seen at 7 leagues. It is invisible to the eastward of N.E. by E. by compass.

This iron tower was made in London, in little more than two months, and weighs 100 tons; diameter at the base, 18½ feet; at the top, 11½ feet; iron 1 inch thick; the tower 105 feet high, 15 of which are sunk in the ground. It is painted white.

13. Portland Rock.—The Portland Rock is a single kay, 15 to 20 feet above the sea, and covered with small bushes. It has been variously represented in from lat. 17° 7½′ to 17° 13′, and from lon. 76° 32′ to 77° 31′. In Mr. De Mayne's Chart it appears in 17° 7½′ N., and 77° 29′ W. The position given in our Table cannot, we think, be far from the truth.—See *Colombian Navigator*, vol. ii. p. 84.

The officers of H.M.S. *Winchester*, in 1834, by numerous altitudes, &c., gained the latitude of the rock as 17° 7′ 25″, and lon. 77° 27′ 4″.

14. Pedro Kays.—These kays have been laid down from a late survey, as shown on the new Chart of Jamaica; they are described in the *Colombian Navigator*, vol. iii. p. 246.

15. Baxo Nuevo.—According to the Spanish officers, 1804, the extent of this shoal is about 7 miles from North to South, and 14 miles from East to West. All the eastern part is a reef, very steep-to; but, on the West, the depth diminishes gradually. At 1¼ miles from the northern extremity is the Sandy Kay, given in the Table. The Baxo del Comboy, which is represented on the charts to the E.S.E. of the New Shoal, has been particularly searched for, but could not be found.

The Baxo Nuevo was examined by the officers of H.M.S. *Winchester*, in or about 1834, who described it as a belt of breakers, inside of which is smooth water, over a sandy bottom. The ship made the East side of it, the two extremities of which then appeared to bear N. by E. and S. by W. from each other, distant 3 or 4 miles. All this side presented one continual line of breakers, with here and there a small spot of sand.

The shoal was again examined by H.M. surveying ship *Thunder*, March, 1835; the small kay, given in the Table, was found to be 4 feet high, and a cable's length East and West, at 6 miles N.E. from the southern breakers; it presents no appearance of vegetation, and is composed of coarse coral, sand, and stones.—*Col. Nav.*, vol. iii. p. 247.

16. Serranilla.—This bank, with its kays, formerly much misrepresented, lies between the parallels of 15° 35′ and 15° 55′ N., and the meridians of 79° 41′ and 80° 5′. On its eastern and southern sides are several kays and reefs. On the N.E. side is a detached patch of rocks, on which the sea constantly breaks; it is just awash, but in fine weather a rock will show about 2 feet out of the water: between it and the main bank is a safe passage, of not less than six fathoms, bordering close to the western side of the reef. In clear weather, by day, all the rocky patches are easily avoided, but it is very dangerous to approach by night.—*Colombian Navigator*, vol. iii. p. 248.

VARIATIONS of the COMPASS.—At the West end of Cuba, and about the Isle of Pines, the present variation is about 8° E. Near the East end, from 5 to 6 degrees. At the Grand Cayman, 7° E. At Port Royal, Jamaica, Mr. Leard, in 1791, gave it as 6° 50′ E.; but there is reason to believe that, for a long time past, it has not exceeded 5½°. In 1824, Mr. De Mayne gave it as 4° 40′ only. At Morant Point, 3° 50′ E. 1843.

17. ST. DOMINGO OR HAYTI, PORTO-RICO, AND THE VIRGIN ISLANDS.

POSITIONS OF PLACES.

	LAT. N.			LON. W.			AUTHORITIES.
ST. DOMINGO.	°	′	″	°	′	″	The Officers acting under the orders of the Spanish Government, for the purpose of ascertaining the Positions of the Principal Points in the West Indies, &c., with subsequent corrections. REMARKS. The results, generally, exhibit the longitudes to the eastward of the situations formerly assigned, although many observations had been previously made by scientific observers. The latitudes found by M. Puysegur, in his surveys of the northern coasts, made, by order of Louis XVI., in 1784 and 1785, have been mostly verified; but the longitudes are from 4 to 6 minutes more to the East. Some previous observations had also been made by Messrs. Fleu-
Isle of Mona; the Middle [1]	18	6	0	67	49	0	
Isle of Saona; S.E. Point	18	12	30	68	32	30	
Isle of Santa Catalina; West Point	18	19	0	69	2	0	
City of St. Domingo	18	28	15	69	58	0	
Punta de Salinas	18	12	0	70	49	30	
Alta-Vela, or the High Sail [2]	18	28	20	71	40	0	
Cape Jaquemel, or Jacmel	18	10	20	72	33	15	
Aquin Bay; the Diamond Rock	18	13	48	73	20	0	
St. Louis; the Old Fort	18	14	27	73	31	30	
Les Cayes; the Town	18	11	10	73	44	0	
Isle à Vache; East Point	18	4	0	73	34	30	
Point Abacou	18	1	0	73	46	0	
Point à Gravois	18	1	20	73	56	30	
Cape Tiburon; Extremity	18	22	0	74	27	32	
Irois Bay; House on the Beach	18	23	46	74	29	33	
Isle of Navaza; Middle	18	24	45	75	3	0	
Cape Dame Marie, or Donna *Maria*	18	36	30	74	27	13	

ST. DOMINGO, PORTO-RICO, ETC.—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Port Jeremie	18 38 0	74 6 0	rieu, Verdun, Borda, and Pingré, in their most useful voyages, made for determining various points of the Atlantic, already mentioned in some preceding notes; but the whole has been rectified in the course of the later operations. The Points of the Western Coast were confirmed, generally, by Mr. Edward Dunsterville, the active and intelligent master of H.M. sloop *Bustard*, in 1826-27.
Pirogues, on the Rochelois Reef	18 37 20	73 12 0	
Hummock of Petit Goave	18 26 51	72 53 39	
Isle of Gonave; West Point	18 55 26	73 18 33	
PORT AU PRINCE; Fort Bigithon	18 32 12	72 22 25	
Arcadins; Northernmost	18 48 0	72 38 0	
St. Marc or St. Mark's Point	19 2 10	72 51 0	
Port Pimont	19 37 0	73 1 0	
St. Nicolas Mole, Fort George	19 49 30	73 27 33	
Port à l'Ecu	19 55 10	73 5 30	
Port Paix; Carenage Point	19 58 0	72 48 45	Mr. Edw. Dunsterville, &c.
Tortue or Tortuga Isle; West Point	20 8 20	72 57 30	
———; East Point	20 1 0	72 36 0	
CITY OF CAPE HAYTIEN; Watering Place	19 46 40	72 10 42	
The Grange Point	19 54 45	71 40 0	
Point Isabelica	19 58 40	71 6 30	
Isabellé Bay; Islet	19 53 50	71 4 7	The Observations of the Spanish Officers, as already explained; particularly those of Captains Don Cosmé de Churruca and Francisco Fidalgo, &c. For some important remarks on the Navigation about Porto-Rico, with a Table of Observations on the Caribbee Islands, &c., by *Captain Zarhtmann*, Hydrographer of the Danish Royal Navy, see *Colombian Navigator*, vol. iii. pp. xix., xx.
Old Cape François	19 40 30	69 55 0	
Cape Cabron	19 21 30	69 14 13	
Cape Samana	19 15 40	69 6 15	
Cape Raphael	19 2 0	68 53 30	
Cape Engano	18 34 30	68 20 30	
Point Espada	18 19 48	68 30 0	
ISLAND OF PORTO-RICO.			
Cape St. Juan, or N.E. Point	18 24 20	65 39 0	
MORRO CASTLE of ST. JUAN [3]	18 29 0	66 7 0	
Point Bruguen, or N.W. Point	18 31 18	67 7 0	
Isle Desecho or Zacheo	18 23 48	67 27 40	
Aguadilla Town [4]	18 25 10	67 7 17	
Point Algarroba	18 14 0	67 7 30	
Puerto Guanica; East Point	17 57 44	66 52 45	
Caxa de Muertos, or Coffin; S.W. Point	17 50 30	66 35 0	
THE VIRGIN ISLANDS.			
Anegada; N.W. Point	18 50 0	64 27 0	Observations of the Spanish and Danish Officers, compared with the Chart by Mr. R. H. Schomburgk, 1832.
———; S.E. Point [5]	18 43 48	64 16 30	
Horse Shoe Reef; South End	18 34 0	64 13 30	
Virgin Gorda; East Point	18 31 7	64 21 30	
Ginger Isle; Centre	18 24 30	64 30 0	
Tortola; Road Town	18 26 0	64 39 0	
St. John's; S.E. Point	18 19 0	64 44 20	
Sta. Monica Rock (9 *feet*)	18 19 0	64 39 30	
St. Thomas Harbour; Fort Christian [6]	18 20 39	64 57 39	
The Bergantin or Curvel	18 18 0	65 7 0	
ST. CROIX or SANTA CRUZ: Eastern Extremity of the Island [7]	17 45 30	64 34 0	A communication made to Mr. Dunsterville, by Sir A. Lang, of St. Croix, Jan. 21, 1832.

ST. DOMINGO, PORTO-RICO, ETC.—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
ST. CROIX or SANTA CRUZ —*continued*			A communication made to Mr. Edward Dunsterville, by Sir Andrew Lang, of St. Croix, January 21st, 1832.
The Lang Observatory...[8]	17 44 32	64 41 0	
Harbour of Christiansted; Flagstaff of the Outer Point Battery, called *Fort Louisa Augusta* ...... [9]	17 45 28	64 41 42	The general height of the tops of the hills in St. Croix is from 800 to 850 English feet above the level of the sea, excepting toward the northern side of the north-western district of the island, where they ascend higher, and the highest of which, called *Mount Eagle*, is 1,156 feet above the level of the sea. Its summit is in lat. 17° 45′ 52″, and lon. 64° 48′ 31″.
Fort Christianswærn, in the Town of Christiansted; Flagstaff.....................	17 44 59	64 41 58	
Salt River Point............[10]	17 47 12	64 44 45	
Hams or N.W. Bluff ...[11]	17 46 24	64 52 3	
Fort at Frederickstæd or Wes End; Flagstaff .... [12]	17 43 10	64 52 48	
Sandy Point; the S.W. Extremity of the island ...[13]	17 40 30	64 53 48	Along the greater part of the South side of the island a ledge of reefs lines the coast, at a distance from shore, in some places, of nearly 2 miles. There are a few channels through these reefs, practicable for small vessels only. —*Andr. Lang.*
Buck Isle; East Extremity [14]	17 47 18	64 36 40	
———— ; North-West Extremity	17 47 30	64 37 37	
Its summit, about 350 feet above the level of the sea	17 47 15	64 37 3	

NOTES.

1. MONA.—A particular description and view of this island are given in the *Colombian Navigator*, 1848, vol. ii. p. 20. Fresh water may be obtained here.

2. ALTA-VELA, or the High Sail.—This is a high rocky islet, which serves as a general point of departure to all ships bound from the eastward to Jamaica, &c. It is peaked, and appears to the northward, at a distance, like a dome, emerging above a mist or fog.—See, further, the Book of Directions above mentioned.

On the authority of the late respected and scientific Admiral Espinosa, of the Spanish Navy, we formerly gave Alta-Vela in lon. 71° 22′ W., instead of a more westerly position, which had previously been assigned: but it is now fully proved that this is wrong, and that the true longitude is 71° 40′ or 71° 41′ W.

In several voyages to Jamaica, Captain J. S. Park, in the ship *Carshalton Park*, has uniformly made Alta-Vela, both by lunars and chronometers, 19 or 20 minutes to the westward of the longitude given on the authority of the Spanish observers. "The first time Mr. Park perceived this great difference, he suspected that there must be something incorrect in his own calculations: even the next voyage, when he passed it again, and found the same difference, he still thought he must be in error: but he has discovered the same thing so often, in succeeding voyages, as to leave little doubt on the subject."

Captain Loudon, of Liverpool, has three times made Alta-Vela in 71° 39′ W., and last time 71° 39′ 30″, on his passage from Deseada.

We have other communications on this point, which do not require a particular detail; and therefore submit the following general statement.

	°	′	″
The Count de Chastenet Puysegur, 1785, gave Alta-Vela in	71	46	0
Mr. James Henderson, Master of H.M.S. *Druid*, 1826	71	46	0
Captain Henry Turner, of the *John Renwick*, of London, 1828............	71	44	30
———————————————— 1829............	71	42	30
Lieutenant John Steele Park, R.N., in the *Carshalton Park*, 1827	71	41	30

	°	′	″
Captain **Loudon**, of the *Marmion*, of Liverpool	71	39	0
Two friends of Captain Loudon	71	39	30
The **French Tables**, Connaissance des Tems, 1826	71	38	45
Mr. **Edw. Dunsterville**, Master of H.M. sloop *Bustard*, 1826	71	38	0
The **same**; **Master** of H.M.S. *Ranger*, in 1829	71	40	50
Mr. **John Leard**, Surveyor of Jamaica, 1792	71	32	0
Captain **Rd. Owen**, H.M.S. *Thunder*	71	39	30
Mean longitude of the whole	71	40	4

3. **Morro of St. Juan.**—The Harbour of St. Juan was surveyed by Don Cosme de Churruca, in 1794. The position given in the Table is from the statement of Don Josef Cerquero, director of the Royal Observatory in the Isle of Leon, near Cadiz. The particulars are given in the *Colombian Navigator*, vol. ii. p. xvii.; and the longitude, as there noticed, is considered as one of the best established in America.

4. **Aguadilla.**—The situation of Aguadilla, as given by the Spanish officers, is 18° 25′ 53″ N., and 67° 6′ 20″ W. Admiral Mackellar gives it as 18° 24′ 57″ N., and 67° 8′ 25″ W. In this, as in some other instances, the mean of the two is the position given in the Table.

5. **Anegada** with its reefs were surveyed by Mr. (since Sir) Rob. Herman Schomburgk, the distinguished traveller, in 1832. We formerly enumerated, in the description of the Caribbean Isles, the number of wrecks that lay upon the reefs in 1811; and Sir R. Schomburgk has noticed that, between 1811 and 1832, twenty-one American, seventeen West-Indian, fifteen Spanish, nine British, two French, two Swedish, and one Portuguese, were wrecked here; and this is attributed, chiefly, to the insensible operation of the currents, as will be shown hereafter.

It is singular that, in a Chart of the Virgin Islands, published as a survey by Mr. Lockwood, in 1811, the N.W. end of Anegada is laid down as high as 18° 57′ N. The Spanish surveyors assigned to the S.E. end of the island 18° 44′ N., and 64° 17′ W. It is to be regretted, that Sir R. Schomburgk has given no detail of his survey, and this leaves a suspicion that Anegada, &c., may really lie more to the North and West than he has represented; for we must take into account the relative situation of Virgin-gorda, St. Thomas's, &c.

Pajaro, or the N.E. point of Virgin-gorda, was given by the late Admiral Lövenorn as in longitude 64° 25′ W. This is wrong. We have given it after the Spanish officers, in 64° 21′ 30″. Sir R. Schomburgk gives it in 18° 30′ N., and 64° 14′ 40″ W.

6. **St. Thomas's.**—With the position of Fort Christian, as given in the Table, from a Danish Survey, compare the communication of Captain J. W. Monteath, *Colombian Navigator*, vol. iii. note 3, p. xx. But, upon this point, we have received the following communication from Sir Andrew Lang:—"The bearings of the flagstaff of *Cowel's Battery*, from my observatory (see note 8, hereafter), N. 21° 54′ 27″ W., from the true meridian, were determined by myself with a Troughton's altitude, azimuth, and transit circle. Notwithstanding the distance (37¼ miles), the flagstaff was distinctly seen with the telescope of the circle, and intersected with the vertical wire. Considering the latitude of the flagstaff, 18° 19′ 32″ N., which must be near it, then its longitude is as stated, 64° 55′ 45″ W., as deduced from my position; but I now strongly suspect that it is a little more to the North, say in 18° 19′ 45″; if so, its longitude, as deduced from my station, will be 64° 55′ 50″ W., and the latitude and longitude of Fort Christian would, on the same data, be lat. 18° 20′ 39″ N., lon. 64° 55′ 39″ W. Fort Cowel is on the very top of an eminence (275 feet above the level of the sea) which rises at the southern extremity of a tongue of land which forms the western side of the entrance, as also, the western shore of St. Thomas's Harbour."—Signed, *Andrew Lang*.

A *lighthouse* has been erected at Muhlenfeldt's Battery on the East point of the entrance of the Harbour of St. Thomas. The light is *red*, the lantern having red panes at S.E., S., and S.W., and is elevated at 95 feet; first shown, August, 1844. To go clear West of the *Triangles*, the East angle of the lighthouse is brought to bear in a line, N. by W. ½ W., with the S.W. corner of a whitewashed kitchen, lying 67 feet North of the tower, and is visible by night from the reflection of the lamp; this will clear the Triangles by a cable's length; the more the kitchen is covered the greater the distance from these rocks.

At the king's wharf in the town (West of Christiana Fort) a lamp with a red glass towards the harbour, will at the same time be seen West of Point Muhlenfeldt; this being free, ships may safely bear away for the harbour.

Prince Rupert's Rock, near the middle of the entrance to the harbour, will always be kept whitewashed, and thereby be visible at night.

7. ST. CROIX.—Fully 9 nautic miles from the eastern extremity, N.E. by E. ½ E. (*true*), and about 11 miles E. by N. from the East point of Buck Island, commences the eastern extremity of an extensive bank or shoal, the northern limit of which rounds off from thence to the N.W., and soon after stretches westerly, inclining to the South of a westerly direction toward Buck Island shoals and reefs, with which it may be considered as connected. The northern edge of the shoal is a coral ledge, several miles in extent, on which 5½ fathoms of water is the least depth yet found; the more common depths being 6, 6½, and 7 fathoms The sea has been observed to break on the whole line of the northern edge, and to the very extremity of the bank, in an alarming manner, during a northerly ground swell in the winter months.

8. OBSERVATORY of SIR ANDR. LANG.—"The height of the observatory above the sea is 440 English feet. The latitude is true to within one second. The longitude is the result, I may say, of the labour of years, and the present assumption of 64° 41′ 0″ in arc, or 4^h 18′ 44″ in time, West from Greenwich, I consider to be determined with almost such absolute certainty, that I do not think the error in the determination can exceed four seconds in time, or one minute in arc, and I trust is less. On that datum the longitudes of the other stations are accurately determined. All the latitudes are certain to one or two seconds."—*Andr. Lang.*

[*From the observatory communication by signal, according to Captain Marryat's code, will be attended to. The observatory is situated about* 1 *mile to the E.S.E. of the town of Christiansted. In clear weather the shoals are distinctly seen.—E. Dunsterville.*]

9. CHRISTIANSTÆD.—Nearly 1 mile due North from the entrance of the harbour of Christianstæd is the western extremity of a reef, called the Scotch Reef, which stretches from thence, with its shoals, fully 1¼ miles to the E.N.E., rendering the approach to the harbour very dangerous to strangers.

10. SALT RIVER.—Salt River Point is comparatively a low point, and one of the most northerly in the island. About one-fourth of a mile to the North of it is a dangerous sunken rock, called the White Horse, on which the sea generally breaks.

11. HAMS BLUFF, along its northern part, is bold-to.

12. FREDERICKSTÆD, or *West-end Bay*, is an extensive and beautiful bay, affording excellent and smooth anchorage, except when the wind has westing; but like all anchorages of that open kind, it then becomes dangerous.

13. SANDY POINT.—To the South of this low and deceiving point, at nearly a mile, there extends a dangerous reef, to which a good berth should always be given.

14. BUCK ISLAND.—This island, except on its southern side, is surrounded with dangerous reefs and shoals, extending fully 1 mile to the W.N.W. of the N.W. point of the island; fully 2 miles to the eastward of its eastern extremity; and about 1 mile to the North of the island; forming, in the intervening bearings, a circuitous connexion of the greatest dangers, which all prudent persons will avoid approaching.

A Royal Ordinance, dated Copenhagen, 6th June, 1833, declared ST. CROIX a free port; and all vessels without exception, Danish or foreign, may have free admittance, and may discharge or load cargoes in the Port of Christianstæd or that of Frederickstæd.

Of goods imported, the following are admitted free of duty:—Corn-meal, Indian corn, rum-puncheons, staves, heading and hoops for sugar hogsheads and rum-puncheons; copper nails, hoes, bills, utensils for boiling sugar and distilling rum, fire-bricks, mules and asses; provision and fresh fruits, such as yams, cassava, bananas, oranges, &c., brought from foreign West India Islands; West India colonial produce, with the exception of coffee and tobacco, on which duty will be required.

VARIATIONS OF THE COMPASS.—From the S.W. end of St. Domingo, where the variation is 5° E., it diminishes to the eastward; and it has lately been found, in the Mona Passage, and about the Virgin Islands, to be from 3° to 1° East. At St. Croix, in 1832, 1¼° E. At Anegada, only 0° 30′ E.

18. THE CARIBBEE AND LEEWARD ISLANDS.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
CARIBBEE ISLANDS. [1]			
Sombrero ....[2]	18 38 0	63 27 30	The observations of the Spanish Officers, &c., rectified, as already explained. The Chart of the Islands and Channels of St. Bartholomew, St. Martin, Anguilla, Dog and Prickly Pear, &c., by Mr. S. Fahlberg, lately published by Mr. Laurie, exhibits different points, as follow:— Dog Island (*Middle*) . . . . 18° 16′ 25″ N. — 63° 27′ 50″ W. Great Anguilla Kay . . . . 18 8 0 — 63 11 45 Anguilla; East Point . . . 18 17 35 — 62 56 45 St. Martin's; West Point . . 18 2 50 — 63 9 50 Hat I. (N.E. of St. Martin) . 18 5 30 — 63 1 0 St. Bartholomew (N.E. Pt.) . 17 53 40 — 62 53 35 Gustavia . 17 51 0 — 62 57 40 It is clear that these islands are very incorrectly delineated in the Spanish chart.
Dog Isle; the centre	18 18 25	63 27 30	
Anguilla Kay.....................	18 8 0	63 11 45	
ST. MARTIN'S; Philipsburg .	18 1 15	63 7 0	
————; West Point...	18 2 50	63 10 0	
Saba; the middle	17 39 20	63 15 0	
St. Bartholomew; East Point	17 53 0	62 52 0	
St. Eustatius; the Road...[3]	17 29 30	63 4 30	
ST. CHRISTOPHER'S; Basse-Terre.........................[4]	17 19 30	62 52 30	
Nevis; Charlestown.........[5]	17 10 0	62 45 0	
Redonda; the Pinnacle	16 55 30	63 29 0	
Montserrat; N.E. Point	16 48 0	62 19 20	
Antigua; St. John's Road [6]	17 9 40	61 52 30	
Desirade or Deseada; N.E. Point....... ....[7]	16 20 0	61 3 45	
GUADALOUPE; Basse-Terre[8]	15 59 30	61 44 46	
Marie-Galante; Basse-Terre .	15 52 0	61 19 15	
The Saintes; Western, S.W. Point	15 51 20	61 41 15	
Dominica; Road of Roseau[9]	15 18 30	61 25 15	
MARTINIQUE; Fort Royal[10]	14 36 7	61 4 10	
St. Lucia; Pt. Moulacique or South Point	13 35 0	61 1 0	
St. Vincent; Kingston	13 9 0	61 16 0	
BARBADOES; Bridgetown[11]	13 5 30	59 37 35	
Granada; Fort St. George [12]	12 2 54	61 48 30	
Tobago; N.E. Point...........	11 20 13	60 32 30	
———; S.W. End ......[13]	11 7 35	60 51 30	
TRINIDAD: [14]			
Point Galera; N.E. Point .	10 50 20	60 54 5	The admirable Survey of the Coasts of Venezuela, &c., by Don Joaquin Francisco Fidalgo, and other Spanish Officers. Published by the '*Direccion Hidrografico*,' at Madrid, in 1816 and 1817. The longitudes adjusted.
Point Galeota; S.E. Point .	10 9 30	60 58 20	
Boca de Navios, or Ship Channel	10 41 45	61 45 30	
PORT SPAIN..................	10 38 42	61 31 45	
Testigos; Centre	11 23 15	63 5 50	
MARGARITA:			
Pampata.........................	10 59 15	63 48 30	
North Point	11 10 30	63 53 30	
Pta. de Arenas, or Sandy Pt.	10 59 0	64 24 30	
Blanquilla; North Point	11 54 30	64 41 50	
Tortuga; East Point	10 54 45	65 13 50	
Orchilla; N.E. Breakers	11 52 45	66 6 30	
Shoal of Two Fathoms.........	12 9 15	66 6 20	
Los Roques or Roccas:			
N.E. Islet	11 58 40	66 39 20	
Islas de Aves (*Birds' Is.*):			
Windward Isle	11 57 30	67 28 20	
Leeward Isle	11 59 30	67 42 35	
Buen-ayre; N.E. Point	12 14 0	68 18 30	
————; S. Point Light [15]	12 2 30	68 22 30	
CURAZAO; North Point	12 24 0	69 9 0	
Bay of St. Anne; Entrance...	12 6 20	68 55 43	
Little Curazao; North End...	12 0 0	68 37 13	
Oruba; S.E. Point	12 23 45	69 57 30	

NOTES.

1. WINDWARD and LEEWARD ISLANDS.—Under the denomination of *Windward Islands*, the navigators of France and Spain include the whole range from the Virgins to Trinidad; and, under that of Leeward Islands, the range which exists between Trinidad and the Gulf of Maracaybo. This distinction is natural and proper, and we have adopted it, in preference to the former distinction in the English charts, which includes, under the name of Leeward Islands, those from Porto-Rico to Dominica only; and, under that of Windward Islands, those from Martinique to Tobago.

The observations of the Spanish officers for determining the respective situations of the Caribbee Islands have been very numerous and important, and our late charts have been regulated chiefly thereby. Some later corrections have, however, been made, particularly in the northern part of the range, and in the Virgin Isles. See Notes 5, 6, 7, and 8, pp. 103, 104.

2. SOMBRERO.—This solitary islet is a flat and rocky eminence, 2¼ miles in length, N.N.E. and S.S.W., without any hummock, having neither quadruped nor vegetable upon it, excepting grass, and that generally dry, with a few weeds, &c. It is even destitute of water. See '*Colombian Navigator*,' vol. iii. p. 64.

3. EUSTATIUS.—The latitude of the road, according to observations made at sea, in the frigate *La Flore*, by Messrs. Verdun, &c., is 7° 29′, and the longitude 63° 2′. The position given in the Table has been corroborated by Captain Monteath:—"1820, 15th November. In latitude 17° 23′; longitude of the East point of Eustatius, by chronometer, 63° 2′ 15″; by lunar observations, 63° 7′ 8″; mean, 63° 4′ 41″."

4. ST. CHRISTOPHER'S.—In January, 1782, the Marquis de Chabert took nine meridian altitudes, whence he concluded the latitude as in the Table. The longitude by his marine clocks, previously examined at Martinique, appeared as 62° 52′ 30″, a result also confirmed by Mr. Zahrtmann.

5. NEVIS.—The latitude, from the observations of Captain Monteath, appeared to be as follows:—"1820, November 15. In 17 fathoms of water upon the bank on the South side of Nevis, Charlestown bearing North, distant about 3 miles, I observed the latitude to be 17° 3′ 30″; adding 3′ on the bearing of Charlestown, gives 17° 6′ 30″; the existing Tables gave 17° 10′ 30″; but this, I am confident, is too far to the North."

A *light*, from a lantern with burners, is hoisted nightly on the flagstaff at the *Fort Point* at Nevis; it is imperfectly seen on the North and South sides, not being visible more than 7 or 8 miles; to the westward it shows a good bright light at about 60 feet, visible 12 or 14 miles.

6. ANTIGUA.—East point of Green Isle. 1820, 14th November, as seen from lat. 16° 55′. Three observations by Captain Monteath: the chronometer gave 61° 39′ 23″; lunars, 61° 44′ 16″; mean, 61° 41′ 50″. St. John's is 3° 3′ 10″ East of St. Thomas, which makes its longitude 61° 52′ 30″.

7. DESIRADE.—From observations made by the Chev. de Borda, he computed the latitude of the N.E. point as 16° 20′ 30″.

Captain Monteath, in lat. 16° 58′, by three observations. Longitude of a ship by chronometer, 61° 9′ 45″; by lunars, 61° 14′ 38″; mean, 61° 12′ 12″. Bearing of Desirade, S. 5° E., distance, 36 miles, which gives 3′ of departure = × lon. 3′ 5″. Hence longitude of the centre of Desirade, 61° 9′ 7″.

8. GUADALOUPE.—The latitude of Basse-Terre has been confirmed from the observations of M. de Verdun, &c. The longitude (assuming Fort Royal, Martinique, as in 61° 9′) appeared to be 61° 48′ 15″; but if Martinique is 4′ 50″ East of this, it will place Guadaloupe in 61° 43′ 25″. The difference of longitude between Guadaloupe and St. Thomas (64° 55′ 39″) has been found to be 3° 10′ 2″, and another measurement makes it 40′ 35″ West of Guadaloupe; these combined will place it in 61° 44′ 16″, as in the Table.

A lighthouse on *Terre de Bas Islet* (or Petite Terre) at the eastern extremity of the Island of Guadaloupe, shows a fixed light at 108 feet above high water, and is visible in all directions for 5 leagues. A rock, called the *Baleine du Sud*, bears S. 19° W., 2,920 feet from the lighthouse. Ships coming from the eastward will find from 13 to 20 fathoms water, at the distance of 2 miles North or South of the light, and should not approach it nearer. M. Tondu, in 1783, concluded the longitude, by three immersions

and two emersions of the first satellite of Jupiter, to be 61° 48′. The latitude of Pointe des Chateaux, the eastern point, was observed by M. de Borda as 16° 12′ 30″.

9. ROSEAU.—The latitude of this place, according to the result of observations by Messrs. Verdun, &c., is 15° 18′ 23″. But the French officers have given the longitude 9½′ to the westward of that shown in the Table, which cannot be correct.

10. MARTINIQUE.—The latitude accords with that resulting from the observations of Messrs. Verdun, Borda, &c., who concluded the longitude as 61° 9′. Mr. Dunsterville gives the longitude of the Diamond Rock as 61° 6′.

In the Survey of Martinique, executed by order of the French government in 1824 and 1825, as shown in the third volume of the *Colombian Navigator*, the longitude of the flagstaff of Fort St. Louis, on which all the other longitudes depend, is assumed by M. Monnier as 61° 1′ 25″. This was arrived at by measurements from Rio Janeiro, &c., and is 3′ less than that now given. See Note 10, in that volume, page xxi., and the Table in page 91; which may be compared with the notes hereto annexed.

The longitude in the Table is assumed from a mean of chronometric measurements by M. Zahrtmann and M. Lartigue, between this and the observatories of St. Croix and St. Thomas, positions which may be considered as finally determined. These differences of longitude are taken as 3° 36′ 58″ East of St. Croix, and 3° 51′ 7″ from St. Thomas.

11. BARBADOES.—The late Dr. Nevil Maskelyne communicated the latitude of St. Michael's Church, in Bridgetown, as 13° 5′ 30″. The longitude has since been given as 59° 43′ 40″ and 59° 41′ 15.″

From four separate measurements of the meridional difference between Port Royal and Barbadoes, it may be taken as 17° 13′ 10″, which will give 69° 37′ 35″ as the longitude of Barbadoes, which, as Port Royal may be considered as the best determined, we have taken. But see note 11, page 99, on the longitude of Port Royal.

12. GRANADA.—In 1779, M. de Chabert concluded the latitude of Fort St. George as 12° 2′ 54″, and its longitude 42½′ West of Fort Royal, Martinique. This varies only 20″ from the statement in the Table. Captain G. Daniell, of H.M.S. *Victor*, in 1833, made the longitude 61° 48′ 30″.

13. TOBAGO.—M. de Chabert, 1781, made the longitude of the *S.W. Point* 20′ to the East of Fort Royal, Martinique: this places the point in only 60° 47½′ W. The position formerly given in the *Connaissance des Tems* was 11° 6′ N. and 60° 49′ W. The Baron Alex. de Humboldt, in his '*Personal Narrative*' (Engl. Transl.), gives it as 10° 20′ 13″ N. and 60° 27′ 30″ W. The latter is evidently a great error, as it would place Tobago directly East of the body of Trinidad. We presume that the N.E. end was intended, and that in 11° 20′ 13″ N., not 11° 10′ 13″, as since in the *Connaissance des Tems*. But if, upon conjecture, we take M. Humboldt's longitude thus, we shall place Tobago too far to the East: for it is allowed that the situation of Trinidad has been settled by the Spanish surveyors, and it is well known that the high land of Trinidad is seen from the ships at anchor in Courland Bay, over the land of Sandy Point, which could not be the case if the former authorities were correct. See the new Chart of the Coasts, &c., from Tobago to Barcelona, published by Mr. Laurie. Captain Daniell, in H.M.S. *Victor*, 1833, made the longitude of Great Courland Bay 60° 51′ 15″.

A *lighthouse* on *Bacolet Point*, at the Port of *Scarborough*, shows a brilliant fixed light at 128 feet; first shown August 1st, 1844. The Minister Rock bears E.S.E. from the light, distant 1½ miles.

14. PORT SPAIN, in TRINIDAD.—Captain Foster (vol. ii. p. 249) makes Fort St. Davids at Port Spain, 0ʰ 52′ 0·8″ West of Parà, which we have placed in 48° 30′ 12″ (Ethiop. Mem., p. xxxiii.), therefore it will make it in 61° 30′ 24″. M. Zahrtmann states it to be 3° 10′ 12″ East of St. Croix, = 61° 30′ 48″; Captain Owen makes it 15° 19′ 0″ East of Port Royal, or 61° 31′ 45″, which is adopted by Lieutenant Raper; this is 2′ 30″ West of the position quoted in the former edition; it has, therefore, been subtracted from the longitude of Trinidad.

Captain Edw. Sabine, R.A., has, from a great number of observations, given the position of the Protestant church in Port Spain as 10° 38′ 56″ N. and 61° 35′ 0″ W. This new and beautiful church is said by Captain S. to be one of the many improvements and decorations for which Port Spain is indebted to its late governor, Sir Ralph Woodford, and which have rendered it one of the handsomest towns in the British colonies. The town is built on a bed of gravel, between 30 and 40 feet deep, resting on a substratum

of clay. The society is agreeable, and there are many natural beauties and curiosities in the island. The meridian of the Protestant church divides the town into nearly two equal parts. See, further, *Colombian Navigator*, vol. iii. p. 118.

15. BUEN-AYRE, or BONAIRE.—A tower, painted white, with vertical red stripes, on the southern point of Buen-ayre, now exhibits a brilliant fixed light, at 70 feet above the level of the sea, which may be seen, in clear weather, 4 leagues off.

VARIATION OF THE COMPASS.—In the channel between Porto Rico and the Virgin Islands the variation is about 3° East; but on the East of Anegada it diminishes to 0° 30′ East. At Antigua and Guadaloupe it is 2° East; and nearly the same thence to Granada. At Barbadoes, only 2°; but at Trinidad, 2° 55′ E.

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19 THE COASTS OF GUYANA, COLOMBIA, ETC., TO THE MEXICAN SEA, INCLUSIVE.

POSITIONS OF PLACES.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
CAPE NORTH	1 51 0	49 50 0 ?	M. De la Condamine and the French Engineers; including Lieutenant Romain Desfossés, who surveyed the "Iles du Salut" in 1834.
Mount Mayez, a landmark	3 5 0	50 55 0 ?	
Cape Orange	4 10 0	51 15 0 ?	
St. Luis of Oyapok; Fort	3 57 0	51 27 0 ?	
CAYENNE [1]	4 56 15	52 20 30	
Iles du Salut; I. Royale [2]	5 16 10	52 32 8	
River Marowyne; Dutch post	5 56 0	53 58 20	The Observations of Lieutenant Bisschop Greevelink, late of the Netherlandish Navy, in the brig *Echo*, 1833—37.
Post Orange [3]	6 1 0	54 36 0	
Mot Creek	6 1 30	54 40 41	
Cameron's Plantation [3]	5 55 30	54 59 0	
Bram's Point, Surinam [4]	5 56 20	55 12 48	
PARAMARIBO: Church	4 43 30	55 13 30	
River Corentyn; Nickerie Battery, on the East [5]	6 9 30	56 52 30	The Topographical Surveys, adjusted by the longitude of Demerary, as given by Captain Owen, &c.
Mary's Hope, on the West	6 14 30	57 2 0	
Berbice; Crab Isle, light [6]	6 24 30	57 22 0	
Corobana Point, Demerary; the Lighthouse [7]	6 49 20	58 11 30	
River Essequibo; extremity of the Leguan Bank	7 0 20	58 18 0	
Boca de Guayma	8 25 0	59 52 0	Lat. "*Derrotero de las Antillas.*" Lon. inferred by chart.
RIVER ORINOCO: [8]			
Punta or Point Barima	8 44 30	60 3 0	Don Cosmé de Churruca and the Baron Alex. de Humboldt.
Isle Cangregos; N.E. Point	8 51 0	60 22 0	
TRINIDAD. *See the preceding Section, page* 105.			
Cape Three Points	10 45 15	62 40 15	The Spanish Surveys of the Coasts of Venezuela, &c., by Don Joaquin Francisco Fidalgo, and other Spanish Officers. Published by the *Direccion Hidrografico*, at Madrid, in 1816 and 1817.
Cape Malapasqua	10 42 50	63 1 0	
CUMANA', the City of [9]	10 27 37	64 9 40	
Puerto de Mochima; Entrance	10 24 0	64 21 0	
Isla Borracha; N.E. Point	10 19 40	64 44 40	
BARCELONA, Morro of	10 13 15	64 43 45	
Piritu Isles; Centre	10 9 0	64 56 0	
Isle Unare; Centre	10 5 15	65 15 25	
Cape Codera	10 35 54	66 6 0	
Chuspa; Point	10 39 30	66 20 0	
La Guayra; Road	10 37 0	66 56 0	
City of CARACAS (*St. Iago de Leon*)	10 30 0	66 55 20	

The whole of the Colombian coast, from the Island of Trinidad to Chagres has been so finely and accurately surveyed by Don Joaquin Fidalgo, and other Spanish

THE COASTS OF COLOMBIA, ETC.—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Puerto de Turiamo	10 29 10	67 51 45	officers, as to leave nothing more to wish for, so far as the survey extends; the South side of the *Gulf of Venezuela* only excepted. Some trifling variations in the longitudes have been made. See Notes. The Spanish Surveys of the Coasts of Venezuela, &c.
PUERTO CABELLO; Entrance	10 29 45	68 2 0	
Punta Tucacas; South Kay...	10 43 0	68 17 5	
Punta de S. Juan	11 9 0	68 28 35	
Punta del Ubero	11 19 30	68 47 15	
Punta del Manzanillo	11 31 15	69 22 5	
Vela de Coro	11 26 30	69 40 5	
CAPE S. ROMAN	12 11 0	70 6 35	
Punta de la Macolla...........	12 5 0	70 19 20	
Santa Anna de Coro	11 24 0	69 47 50	
Fort or Castle of Zapara	10 58 30	71 38 30	
MARACAYBO; Town	10 39 0	71 43 0	
Punta de Espada	12 4 0	71 9 50	
Bahia Honda; Entrance	12 20 0	71 48 35	
CAPE LA VELA	12 11 0	72 13 35	
Rio de la Hacha; Town	11 33 30	72 56 55	
Cape S. Augustin	11 16 0	73 38 5	
Cape S. Juan de Guia	11 20 45	74 2 20	
Cape de la Aguja	11 18 30	74 14 20	
SANTA MARTA ....[10]	11 15 0	74 15 0	
Rio Magdalena:			
Boca de Rio Viejo............	11 5 0	74 45 35	
Boca de Ceniza...............	11 5 20	74 53 45	
Pueblo de Barranquillas ...	10 59 0	74 48 27	
Punta de Savanilla	11 2 0	75 0 25	
Morro Hermosa*	10 58 0	75 2 10	
Cascabel Rock	10 55 10	75 5 10	
Palmarito Shoal..................	10 51 45	75 16 25	
Punta de la Galera	10 47 0	75 26 30	
Punta de Canoas	10 34 15	75 33 0	
CARTAGENA; Popa ...[11]	10 26 0	75 33 15	
Salmedina Bank (2 fms.)......	10 23 0	75 40 46	
Boca Chica; Entrance.........	10 19 30	75 36 17	
Islas del Rosario; larger I....	10 11 0	75 45 45	
Islas de S. Bernardo; Tintipan or North I.....................	9 48 0	75 51 30	
Santiago de Tolu	9 30 45	75 36 50	
Puerto de Cispata; Entrance .	9 25 0	75 48 5	
Isla Fuerte........................	9 23 30	76 11 15	
Punta Arenas; Entrance of G. of Darien	8 33 0	76 56 15	
Cape Tiburon	8 41 15	77 22 46	
Puerto Carreto	8 47 15	77 34 45	
Isla de Pinos; N. Point of ...	9 1 30	77 46 0	
Cayo Ratones......	9 23 0	78 16 15	
Punta S. Blas; E. Point	9 34 36	78 57 40	
Punta del Manzanillo	9 39 30	79 32 12	Captain E. Barnett, 1840.
PUERTO VELO, or Porto-Bello; Town	9 32 30	79 39 12	
CHAGRES; St. Lorenzo Castle ....[12]	9 19 39	80 0 15	
Escudo or Shield of Veragua; Centre	9 6 0	81 33 42	
Boca del Toro; Entrance ...	9 22 0	82 15 0	
Boca del Drago; Entrance ...	9 26 0	82 22 0	
Monkey Point	9 30 0	82 40 42	

REMARKS.

* The MORRO HERMOSA, in lat. 10° 58′, is a hill which constitutes a useful landfall westward of the Magdalena, and is noticed as such in the *Colombian Navigator*, vol. iii.

There is said to be a rock, at 5½ miles to the W.S.W. from the Morro, in lon. 75° 10′, and at about 3½ miles from the nearest land, not laid down on the Spanish Chart. It has 6 fathoms of water around it, with only 11 feet on its centre. The *Cascabel*, or *Cascavel*, lies within it, off the Rio Caimanes, at only half a league from shore, and cannot, therefore, be the same.

THE COASTS OF COLOMBIA, ETC.—continued.

	Lat. N. °	′	″	Lon. W. °	′	″
Point Blanco	10	1	40	83	5	42
S. Juan de Nicaragua, or del Norte; Sandy Point	10	56	45	83	42	0
Islands, &c., in the Bay of Guatemala.						
Serranas; S.W. Kay [13]	14	16	0	80	22	0
Quita Sueno; S.E. Point	14	7	0	81	8	0
Roncador Kay, on N.W. Reef	13	34	30	80	5	15
Providence Island; Sta. Catarina.	13	23	0	81	22	30
St. Andrew's; Centre	12	35	0	81	43	0
Courtown, or E.S.E. Kays	12	24	15	81	28	0
Albuquerque, or S.S.W. Kays	12	10	0	81	51	0
Mosquitia or Mosquito Shore.						
Blewfield Bluff [14]	11	19	20	83	40	18
Punta Gorda	11	28	0	83	47	0
Parrot Isle (135 feet high)	11	30	38	83	42	30
Man of War Kay; N.E. Kay	13	1	0	82	58	50
Bragman Bluff; N. part	14	3	0	83	31	40
Mosquito Kays; S.E. Kay	14	21	15	82	45	50
Cape Gracias a Dios.	14	59	30	83	12	0
Carataska Lagoon; Entrance	15	23	40	83	43	0
Point Patook	15	49	15	84	17	7
Poyais Peak (3,600 feet high)	15	46	0	84	53	30
Cape Camaron; E. extremity	16	0	30	85	2	40
Cape Honduras	16	1	30	85	59	30
Bonacca; N.E. extremity	16	30	0	85	47	37
Ruatan; Port Royal	16	23	45	86	19	0
Utila; highest hill (295 feet).	16	7	45	86	53	30
Swan Islands East Point	17	24	30	83	52	50
Misteriosa Bank; N.E. part	18	56	15	83	41	38
The Coast continued:						
Peak of Congreboy (7,500 feet)	15	38	55	86	54	0
Cape Triumfo; Point	15	48	45	87	27	56
Omoa; Low West Point	15	47	10	88	4	40
Cape Three Points; Extrem.	15	57	45	88	38	50
Rio Dulcé; Entrance	15	49	45	88	46	32
Point Icacos	16	14	15	88	35	54
Point Placentia	16	30	53	88	23	30
Colson's Point N.E. Extremity	17	4	15	88	15	0
Balize Fort Islet	17	29	20	88	11	30
Outer Kays and Reefs						
Glover's Reef; N.E. Extremity	16	55	0	87	43	50
———; S.W. Kay	16	42	20	87	50	57
Half-Moon Kay; *Lighthouse* [15]	17	12	11	87	32	24
North Kay on Lighthouse Reef	17	28	20	87	27	0
Turneff; Kay Bokel	17	8	30	88	55	58
———; Mauger Kay	17	36	15	87	46	40
Rendezvous Kay	17	15	0	88	0	45
English Kay; Flagstaff	17	19	25	88	0	20
Goff's Kay	17	20	55	87	59	15
St. George's Kay; Anchorage	17	33	15	88	4	54

Authorities.

The Observations and Surveys of Captain Richard Owen, in H.M.S. *Blossom* and *Thunder*, between 1828 and 1837.

Remarks.

The whole of the coasts of the Bay of Honduras, from Cape Gracias a Dios to Cape Catoche, including the isles and shoals between the Pedro Bank and Costa Rica, have been surveyed under the able direction of *Captain Owen*; Lieutenant, now Captain, *Bird Allen*; Lieutenant, now Captain, *Edw. Barnett*; Lieutenant *Jas. Cannon*, and other skilful officers of the British Navy These important surveys have been the means of correcting enormous errors in the representation of the Gulf of Honduras, and they have also given, for the first time, a true representation of the Rio and Golfo Dulcé, the coasts of which were never before explored.—*Colombian Navigator*, vol. iii. p. 24.

The Observations and Surveys of Captain Richard Owen, &c.

Remarks.

The town of Balize is the only regular establishment which the English settlers have formed in this country It is immediately open to the sea and though the situation is low, the groups of lofty cocoa-nut trees, with the thickly interspersed and lively foliage of the tamarind, contribute to give a very picturesque and pleasing effect to the dwellings of the inhabitants, independent of the advantage that is conferred by their grateful shade. The reefs and kays off the coast are those named *Glover's Reef*, the *Lighthouse Reef* and Kays, *Turneff*, or the Drowned Island, and the *Northern Triangle*. The Lighthouse Reef has been generally

THE COASTS OF COLOMBIA, ETC.—CONTINUED.

	LAT. N. ° ′ ″	LON. W. ° ′ ″	AUTHORITIES.
Northern Triangle; South End	18 23 30	87 23 0	known under the name of the *Eastern Reef*; it is 8 leagues in extent from N.N.E. to S.S.W., and is steep-to, excepting the S.E. point, now distinguished by its lighthouse. The Observations and Surveys of Captain Richard Owen, &c.
——————; North Kay	18 45 0	87 19 0	
Shamrock Bay; S.E. Point ...	19 17 30	87 28 0	
Ascension Bay; South Point .	19 36 15	87 25 15	
KilbrideCliffs; StoneBuildings	20 11 45	87 25 50	
Cosumel; South Point	20 16 0	86 59 39	
———; N.E. Point	20 35 30	86 44 34	
Mugere Isle; South Point ...	21 12 15	86 43 15	
Punta Brava	21 0 0	86 44 0	The Surveys of Captain Edw. Barnett, R.N., of H.M.S. *Thunder*, 1837.
CAPE CATOCHE	21 33 50	87 56 5	
Yalahau Spring..................	21 27 30	87 25 0	
Lagartos; Vigia	21 36 15	88 10 0	
Sisal Fort	21 10 6	90 2 47	
Monte No-te-perderas; 80 feet	21 10 0	90 5 30	
Jaina	20 5 0	90 30 10	
CAMPECHÉ; Plaza ......[16]	19 50 45	90 33 0	
Morros Point	22 45 0	90 40 15	
ALACRAN SHOAL; Whale Rock, N.W. end	23 27 0	89 48 0	
Port Alacran; Huts on Perez Island	22 23 6	89 42 50	
East Triangle; Beacon.........	20 54 54	92 13 21	
Arenas Kay	22 7 10	91 24 30	
Javinal Point.....................	19 12 0	90 53 0	The Spanish Surveys of the Mexican Sea, 1808—1814, with emendations by Admiral Mackellar, of the British Navy, and by the Baron Alex. de Humboldt, &c.
Punta de Xicalango	18 41 0	91 50 0	
Barra de S. Pedro...............	18 40 0	92 25 0	
Barra de Tabasco	18 34 30	92 35 0	
Barra de Chiltepeque	18 26 30	92 59 0	
Rio Tupilcho; Entrance of...	18 26 0	93 21 0	
Barra de Goazacoalca	18 10 0	94 17 0	
La Barilla	18 10 0	94 30 0	
Punta de S. Juan	18 18 0	94 33 0	
Roca Partida, or *Cleft Rock*...	18 43 0	95 2 0	
BARRA de ALVARADO.........	18 45 0	95 42 0	
VERA CRUZ; *The Lighthouse* ....[17]	19 12 15	96 7 12	
Xalapa	19 30 8	96 55 0	
Cofre de Perote ....[18]	19 32 54	97 8 0	
Peak of Orizaba or Orizava...	19 2 17	97 12 15	
Puebla de los Angeles	19 0 15	98 2 45	
Toluca	19 16 19	99 21 45	
Tescuco	19 30 40	98 51 15	
MEXICO . ...[19]	19 25 45	99 5 30	
Cape Roxo.........................	21 16 0	97 18 0	
BARRA de TAMPICO	22 15 56	97 50 18	
Barra de Santander	23 46 0	98 2 0	
Boquillas Cerradas	25 0 0	97 45 0	
Rio Grande del Norte, or Rio Bravo, Mouth of * ......[20]	25 56 0	97 11 30	Commodore Moore, and Captain Baylein, of the Texan Navy; 1841.
Brazos de Santiago	26 6 0	97 12 0	
Padre Island; North End [21]	27 36 50	97 16 5	
Mustang Island; S.W. End .	27 37 20	97 16 0	
——————; N.E. End .	27 49 15	97 3 54	
St. Joseph's Island; S.W. End	27 53 0	97 3 24	
——————; N.E. End	28 5 0	96 51 44	
Matagorda Island; S.W. End	28 5 56	96 51 0	

* The RIO BRAVO del NORTE is the south-western boundary of the territory claimed by the State of TEXAS.

THE COASTS OF COLOMBIA, ETC.—CONTINUED.

	LAT. N.	LON. W.	AUTHORITIES.
	° ′ ″	° ′ ″	
Matagorda Island; N.E. End, or West Point of Paso Cavallo....................[22]	28 19 24	96 22 5	Commodore Moore, and Captain Baylein, of the Texan Navy, 1841.
Decrow Point; E. Entrance of Paso Cavallo	28 24 0	96 20 0	
Caney Creek; Mouth	28 38 0	97 57 0	
San Bernard River; Mouth...	28 51 0	95 49 0	
Velasco; Mouth of Brazos River	28 58 0	95 33 0	
San Luis; S.W. End of Galveston Island................	29 2 0	95 22 0	
Galveston; Fort at the N.E. End of Galveston Island[23]	29 18 50	94 48 30	
Sabine River; W. Side of the Entrance.................[24]	29 39 48	93 52 15	

NOTES.

1. Cayenne.—The situation of this town was given by M. De la Condamine, in 1774, from four eclipses of the first satellite of Jupiter, as in 52° 16′ 30″; but the longitude in the Table is inferred from Maranham: the difference of longitude between them having been ascertained by MM. Roussin and Lartigue. The town and fortress are situate on the N.W. point of the island, the North part of which has various hills and eminences, close to the coast; but the South part is low, and wet in the season of the rains.

2. Iles du Salut, or Islets of Health.—These were formerly called the *Devil's Islets*, but they form a fine and well-sheltered harbour. The best anchorage is with the southern islet, *St. Joseph*, E.S.E., in 5 or 6 fathoms, hard bottom at about a musket shot from shore.—*Colombian Navigator*, vol. iii. p. 156.

3. Coast between the Marowyne and Bram's Point.—To Lieutenant *B. Greevelink*, late of the Netherlandish Navy, the public is indebted for that valuable description of the coasts of Guyana and its several ports, which is included in the third volume of the *Colombian Navigator*. The following are extracts from the same, on the coast between the Marowyne and Bram's Point.

"The coast between the Marowyne and Surinam Rivers lies still uncultivated, with the only exception of *Mr. Cameron's plantation*, noticed beneath; and nothing but thick wood, of an almost uninterrupted uniformity, presents itself to the view, without the smallest emerging object. In making *Post Orange*, which is in longitude 54° 36′, you will see the Dutch flag hoisted there, and a few houses, of a dark brown aspect, lying nearly hidden in the forest. This post lies nearly 13 leagues to the westward of the Marowyne, and at about the same distance from Bram's Point.

"It ought to be remarked that, although in former times there may have existed some likeness between Post Orange and Bram's Point, at present none such is to be found; the large tree at Post Orange, mentioned in former descriptions, is probably fallen or dead, and the flag only may serve to distinguish the spot. At Bram's Point, however, no flag is now to be seen. At about 5 miles to the West of Post Orange is the *Mot-Kreek* (Mot Creek), where also the Dutch flag is displayed, as a mark for ships; a few houses, in a similar manner, lie scattered among the trees.

"The next mark you have (for you must be very attentive in keeping a good look-out) is a break in the land, through which appear the houses and buildings of a plantation, called *Cameron's Castle*. The mansion, a large structure, painted white, has a steeple or tower upon its roof, which makes it the best mark on this part of the coast."

4. Surinam River.—In 1817 a beacon was erected on Bram's Point, but since 1832 it has broken down, together with the houses, flagstaffs, and every other object previously existing; so that, at present, not the smallest trace of human habitation is to be

seen there: but two iron vessels with masts, and two copper buoys, have been laid down, as a guide to the river.—*Colombian Navigator*, vol. iii. p. 135.

5. The Corentyn.—Between the Surinam and the Corentyn, an extent of about 30 leagues, the shore is generally low, flat, and sandy, and the whole of it is bordered by a mud bank, which is, in some places, not less than 5 miles broad. The Corentyn has been described by M. Schomburgk, as shown in our former work; but we may here repeat the remark that, judging from the difference of latitude between Demerary Lighthouse (in 6° 49′ 20″), and Mary's Hope, as given on the best existing maps and charts, we have already expressed our apprehension that Mr. Schomburgk's latitudes are about 12′ too far South; an impression which we still retain. As the error, *if such*, is a very dangerous one, it requires the more particular notice.

6. Berbice.—A light-vessel lies N.N.E. 10 miles from the entrance of the river (in lat. 6° 25′ 42″ N., lon. 57° 26′ W.), showing one fixed light by night, and a black ball at the foremast-head by day. She is painted black outside, and roofed over; has a smaller jigger-mast abaft; and lies in a quarter less 3, low water.

7. Demerary.—On making the coast about Demerary, as on that to the eastward, similar precautions must be taken. The river is half a league wide at the entrance, but obstructed by a bar of 9 to 11 feet at low, and 18 or 19 at high, water. *George Town*, on the East bank of the river, is 1½ miles from the fort, defending the entrance.

The *lighthouse* upon Corobana Point on the eastern side exhibits a bright fixed light, which may be seen at 4 leagues off; but those approaching should be cautious that another light on shore may not be mistaken for the lighthouse. The navigation has also been facilitated by a light-vessel, which was placed off the entrance in 1838, in the depth of 3½ fathoms at low water, which likewise exhibits a fixed light. From the light-vessel the lighthouse on shore bears S.W. by S., 12 miles distant. Vessels inward bound engage pilots from the floating light, upon heaving to for that purpose.—*Colombian Navigator*, vol. iii. pp. 133, 141, 146.

8. River Orinoco.—For the positions given by M. de Humboldt, &c., see the English translation of his *Personal Narrative*, vol. v. pp. 719, 720. Here it may be noticed that no regular survey of the mouth of this river has yet been made, and we have even some reason for believing that the given longitude is to be considered only as an approximation. It should farther be understood, that the Points Barima and Sabaneta have been confounded with each other. The Punta Barima, or Cape Bremé, of the English and Dutch charts, is the Sabaneta Point of the Spanish: and the Sabaneta Point of our charts is the Punta Barima of theirs. For the points of the interior, see the *Colombian Navigator*, vol. iii. table, p. xi.

9. Cumana.—The Castle of S. Antonio, on which the Venezuelan flag is occasionally hoisted, is only 30 toises (31¾ fathoms) above the level of the sea. Placed on a naked and calcareous hill, it, however, commands the town, and forms a very picturesque object to vessels entering the port. The longitude is given from Baron A. de Humboldt.

The principal establishments for commerce on this coast, and toward which vessels from Europe, in general, direct their course, are Cumana, Barcelona, La Guayra, and Porto Cabello; Maracaybo, Santa Marta, and Cartagena; Pampatar, in the Island of Margarita, and St. Anna in Curazao. It is a general rule on the coast to make the land to windward of the port of destination, in order to prevent falling too far to leeward. Having once entered the Caribbean Sea, it will be proper to make the land about Cape Three Points, or Cape Malapasqua, if bound to Cumana or Barcelona; and those bound to La Guayra will make Cape Codera, &c.

10. Santa Marta.—The meridional distance between Port Royal and Santa Marta, by several measurements, appears to be 2° 35′ 45″, which places it in the given longitude.

11. Cartagena.—According to the longitude of Chagres, which is nearly that of Captain Barnett, this coast should be altered 3′ 50″ East of the Spanish Surveys; therefore, as there cannot be any very considerable error in the Spanish longitudes in the short meridional distance between these places, we have applied this correction.

12. Chagres.—As this place is important, as being the connecting point, with Panamá, of the measurements between the eastern and western sides of the American continent, we give the data for the longitude in the Table. Captain Foster makes it 3° 48′ 41″ West of Morant Point, equal to 80° 0′ 0″; and from Baracoa 50° 30′ 6″, equal to 80° 0′ 37″ (see Note 3, C. Maysi, page 98). Captain E. Barnett's measurement from

Port Royal, which accords also with other observations, 3° 9′ 22″, makes it 80° 0′ 7″: the mean of these is 80° 0′ 15″. The latitude is by Commander Barnett, 1840.

13. The SERRANAS, *Quita Sueno*, *Roncador*, and *Isle of Providence* (*vulgo*, Old Providence), are described in the *Colombian Navigator*, vol. iii. pp. 248, 259.

Providence is 6 miles long from North to South, and 3 miles broad. The hills of Providence vary from 200 to 600 feet in height; but its highest summit, in lat. 13° 21′ 10″, lon. 81° 21′ 50″, is 1,190 feet high: its head, as seen from the north-westward, droops toward the East: there is a small peak, close to the westward of it, of 1,154 feet. These isles are included in the government of St. Andrew's, the residence of the governor.

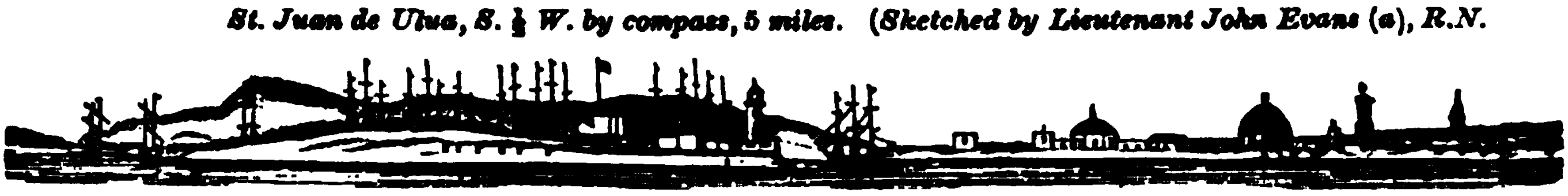
14. BLEWFIELD BLUFF.—Blewfield Lagoon may be considered as the boundary of the Mosquito country. The bluff, which marks the North side of the entrance, from all directions makes like an island, being connected with the main by a very narrow isthmus. Its height is 150 feet, and breadth from East to West about a mile. Cliffs reddish and very bold.

15. HALF-MOON KAY.—The kay is low and bushy. The lighthouse upon it, erected in 1821, exhibits a fixed light, at about 50 feet above the sea, and is useful to strangers bound to Balize as well by day as by night; for it very frequently happens that they get considerably to the southward of the fairway, owing to the indraught to the south-westward, &c. The lighthouse is situate on the eastern point of the KAY, and resembles a pyramid, being 22 feet square at the base, and diminishes to the lantern to 10½ feet. The whole is neatly shingled, and painted white; but the light is a very inferior one, and not visible more than 2 leagues off. The branch pilots for Balize have their station on this kay, and will come off on a vessel's approaching.

16. CAMPECHE′.—This coast has been surveyed by Captain Edw. Barnett, commanding H.M.S. *Thunder*, as noticed in the *Colombian Navigator*, vol. iii. p. 317. It will be seen by comparison that the North coast of Yucatan is placed to the northward of its former latitude.

17. VERA CRUZ.—There is a most excellent revolving light on the N.W. corner of the castle of S. Juan de Ulua. The machinery was made in London; and there is a spare set, lest any accident should befal that now in use. The centre of the lantern is elevated 79 feet above the level of the sea; the light is from twenty-one lamps, having reflectors, seven on each side of a triangle, which make the revolution as follows: From the first appearance of light, it appears bright for about six seconds; then a faint glimmering for forty seconds, and so on alternately. This light may be seen 12 miles off in clear weather.

St. Juan de Ulua, S. ½ W. by compass, 5 miles. (Sketched by Lieutenant John Evans (a), R.N.



Lighthouse *Vera Cruz.*

The tower is round, painted red and white, in vertical stripes, with a green top.—See *Colombian Navigator*, vol. i. p. 175.

18. PEAK of ORIZABA and COFRE de PEROTE.—The situations of these celebrated mountains are indicated in the charts. The first, which is always covered with snow, is stated, by the Spanish Surveyors, to be 6,517 varas (2,981 English fathoms) in height, above the level of the sea; and its highest point may be seen, above the horizon, at the distance of 50 leagues. Its true bearing and distance from Vera Cruz are W. 9° S. 61 miles. This mountain, of a conic form, became volcanic in 1545, and continued for twenty years; since which time there has been no appearance of inflammation. Though the summit is clothed with perpetual snow, the sides are adorned with beautiful forests of cedars, pines, and other trees.

The *Cofre de Perote* is stated to be 2,332 English fathoms high, above the level of the sea. Its distance from the nearest part of the coast is about 13 leagues.

19. MEXICO.—In the old maps, charts, and tables, this city is placed a degree too far to the westward: the sea coast was also placed nearly as much too far to the West. The difference is shown by the map of the Mexican provinces, constructed by M. de Humboldt.

20. RIO GRANDE DEL NORTE.—This is the boundary of the territory claimed by the

State of Texas. We have inserted the positions on the coasts from the Surveys of Commodore Moore, as given in the *Journal of the Geographical Society*, vol. xiii. 1845, p. 243.

21. PADRE ISLAND trends N. ¼ E., *true*, 38 miles, and then N. ¼ W., *true*, 53 miles, to the North end in Corpus Christi Inlet, which has 4 feet water on its bar. At the back of this Island is the Laguna del Madre. The entire coast, from the Brazos di Santiago, on the South of the island, is clear, and can be approached with safety to within 1½ miles, except at the entrances, where the breakers always show.

22. PASO CAVALLO.—Of Paso Cavallo, or Passo Caballo, the bar is S. by E. from the East end of *Matagorda* (Thick Bushes) *Island*, distant 3 miles; from thence it runs due West to the island, and N. by E. ½ E. to the peninsula forming Matagorda Bay. There are two beacons here, but not placed right.

23. GALVESTON BAY.—It has been more than once announced that there were proper beacons and lights shown at the entrance of this bay, but which, having been incorrect, led to some serious misfortunes. It is, however, again stated, in the official description of the United States' Lighthouses (1850), that a lighthouse is building on Bolivar Point, the East side of the entrance; and also that there is a *light-vessel*, moored inside the bar in 3½ fathoms, with one bright fixed light, first shown in 1849.

24. RIVER SABINE.—According to a survey of the mouth of this river, by Major Grahame, Captain Pelham, and Lieutenant Lee, of the U.S. and Texan Engineers, the mound at the West side of the mouth is in lat. 29° 47′ 21″ N., and lon. 93° 50′ 14″ W. The mouth is obstructed by a bar of 5½ feet.

VARIATION OF THE COMPASS.—Near Cayenne the variation was 2° 29′ E., in 1834: at Demerary it was 4° 50′ E., in 1835. From the Island of Trinidad, where the easterly variation is about 3°, that variation is found to increase to the westward. By observations made in and subsequent to 1816, it has been found to exist as follow:—At Cape Vela, and thence to Chagres, from 6° to 7° E.; at the Isle of St. Andrew, in 1834, 7° E.; at S. Juan de Nicaragua, 7° 20′ E.; in the Bay of Honduras, 8° E., 1841; at Vera Cruz, 9° E.; and at Tampico, 8½° E., in 1833; off the mouth of the Rio Grande del Norte, 9° 15′ E.; off Galveston, 8° 30′ E., 1844.

SECTION II.

GENERAL OBSERVATIONS ON THE WINDS, TIDES, AND CURRENTS, AND ON THE DIFFERENT PASSAGES OVER THE ATLANTIC OCEAN.

I.—OF THE WINDS AND TORNADOES.

WINDS IN GENERAL.—The Winds are divided into PERENNIAL, PERIODICAL, and VARIABLE. They are also divided into General and Particular.—PERENNIAL, or Constant Winds, are those which always blow the same way; such as that easterly wind between the tropics, commonly called the TRADE WIND.—PERIODICAL WINDS are those which constantly return at certain times: such are land and sea breezes, blowing alternately from land to sea, and from sea to land.—VARIABLE, or Erratic Winds, are such as blow now this way, now that, and are now up, now hushed, without regularity as to time or place: such are the winds prevalent in England, &c.

WINDS are generally found to vary according to the situation of land; for the temperature of the land, according to the degree to which it is heated by the sun, always affects the disposition and strength of the wind. Thus, it is found that the heated land of Africa, by rarefying the atmosphere, produces a breeze from the sea; and from this circumstance it arises that lands, which would otherwise be parched up or burnt, are rendered habitable. It is observed, generally, that the continental coasts, between the tropics, are almost always blown upon *obliquely*, from seaward, by winds whose course is affected by the winds which prevail in the extensive seas that surround them. It is even well known, as a fact, that during the greatest part of the summer and autumn the wind blows from the North along the western coasts of PORTUGAL and SPAIN, so that

the passage from Lisbon to Falmouth is seldom accomplished in less than a fortnight, and often occupies more.

PERENNIAL OR TRADE WINDS.—These* mighty currents in our atmosphere, on which so important a part of navigation depends, arise from—1st, the unequal exposure of the earth's surface to the sun's rays, by which it is unequally heated in different latitudes; and 2ndly, from that general law in the constitution of fluids, in virtue of which they occupy a larger bulk, and become specifically lighter, when hot than when cold. These causes, combined with the earth's rotation from West to East, afford an easy and satisfactory explanation of the magnificent phenomena in question.

The sun is constantly vertical over some part of the earth between the tropics, and this zone is consequently maintained at a much higher temperature than the regions nearer the Poles. This heat on the earth's surface is imparted to the air, which is, therefore, displaced and buoyed up from the surface, and the colder, and therefore heavier, air from without glides in, on both sides, along the surface; while the displaced air, thus raised above its due level, and unsustained by any lateral pressure, flows over, as it were, and forms an upper current in the contrary direction, or towards the Poles; which being cooled in its course, and also sucked down to supply the deficiency in the extra-tropical regions, keeps up thus a continual circulation.

Since the Equator revolves much more rapidly than the portions nearer the Poles, it follows, that a mass of air flowing towards the Equator must be deficient in rotary velocity, and, therefore, unable to keep up with the speed of the new surface over which it is brought. Hence these currents from the North and South must, as they glide along the surface, at the same time lag or hang back, and *drag upon* it in the direction *opposite* to the earth's rotation, *i.e.*, from East to West. Thus, from simple northerly and southerly winds, they become permanent *north-easterly* and *south-easterly winds*.

The lengths of the diurnal circles increase very slowly near to the Equator, and for several degrees on each side of it hardly change at all. It follows from this, then, that as these winds approach the Equator, their easterly tendency must diminish; and at the Equator must be expected to lose their easterly character altogether. And not only this; but the northern and southern currents, here meeting and opposing, will mutually destroy each other, leaving only the actions of local causes, which may lie in one region in one way, and in another a different one.

The result of this, then, is the production of two great tropical belts of north-easterly and south-easterly winds, while the winds in the equatorial belt which separates the two former should be free from any steady prevalence of an easterly character, and should also be comparatively calm. All these consequences are agreeable to observed fact, and constitute the system of the regular *trade winds*.

The constant friction of the earth upon the air near the Equator, it may be objected, would, by degrees, destroy the rotation of the whole mass; but it is compensated in this manner. The heated equatorial air, rising and flowing off toward the poles, carries with it a rotary velocity much greater than that of the surface over which it passes in its northward and southward progress. Hence it will gain more and more on the surface of the earth, and assume more and more a *westerly* relative direction; and when, at length, it necessarily returns to the surface in its circulation, which it must do, more or less, in all its course, it will act on it by its friction as a powerful S.W. wind in the northern hemisphere, and a N.W. wind in the southern, and thus restore the equilibrium. This is the origin of the S.W. and westerly gales so prevalent in our latitudes, and of the almost universal westerly winds in the North Atlantic.†

* See Sir J. F. W. Herschel's "Astronomy," p. 128, §§ 194—200; and also Captain Hall's "Fragments of Voyages and Travels," 2nd Series, vol. i. p. 162.

† *Sir John Herschel* gives the following note, in his work upon the origin of storms, which, as it is most feasible, we give here; it must be observed, that it was written before the views and observations of Reid, Redfield, and others, had been published. We shall advert to it hereafter.

"It seems worth inquiry, whether hurricanes in tropical climates may not arise from portions of the upper currents prematurely diverted downwards before their relative velocity has been sufficiently reduced by friction on, and gradual mixing with, the lower strata; and so dashing upon the earth with that tremendous velocity, which gives them their destructive character, and of which hardly any rational account has yet been given. Their course, generally *speaking*, is in opposition to the regular trade wind, as it ought to be, in conformity with

The foregoing principles will be elucidated by the following statements, to which, on attention, they will be found applicable; but it must be observed, that the effects are modified by local causes. If the whole of the intertropical regions were covered with the ocean, the above principles would probably be found to prevail without any deviation; but from the interposition of the continents, which break the continuity of the effects produced by the sun's passage, very different results are formed by them on the land and upon the open ocean.

Thus, on the Atlantic Ocean, at about 100 leagues from the African shore, between the latitudes of 10 and 26 degrees, a constant breeze prevails from the north-eastward. Upon approaching the American side this N.E. wind becomes more easterly, or seldom blows more than one point of the compass from the East, either to the northward or southward. This appears to be caused by the heated lands to the westward rarefying the air, and causing an indraught that way, as a contrary wind is induced on the African coast.

The PERENNIAL or TRADE WIND, on the American side of the Atlantic, extends, at times, to 30° of latitude, which is about 4° farther to the northward than on the African side. Likewise on the South of the Equator the trade wind, which is here from the S.E., extends 3 or 4 degrees farther toward the coast of Brazil, than on the opposite side of the ocean.

Mr. Dunsterville has noticed that, when approaching the West Indies, the wind invariably, on advancing northward from the trade winds, veers to the south-eastward, thence round to the S.W. and westward; and, in the winter months, even to N.W. and N.N.W.

HEAT increases evaporation, and renders the atmosphere capable of supporting a greater quantity of moisture than it would do in a cooler state: this is a powerful agent in the causes which produce a diversity of winds and weather, especially to the northward and southward of the tropics; for, by this addition of moisture, the air is more fully expanded, and becomes specifically lighter, than it would be in the same degree of heat in a drier state.

Were the atmosphere of one continual warmth, and its motion uniform, there would be no rain; for it would not imbibe more moisture in exhalation than it could support; therefore in a perennial wind, notwithstanding the great evaporation, there is seldom any rain; but, from accidental causes, these winds are alternately stronger and weaker, with frequent clouds, and sometimes light showers.

These circumstances are assumed as prevailing at a considerable distance from the land, and from the limits of the trade wind; for everywhere near the land, when the sun has great influence, it occasions land and sea breezes near the shores; and, in particular situations, heavy gusts and squalls of wind. The trade winds are more steady and uniform in the Pacific Ocean, from its greater extent, and also in the Ethiopic, than in the Atlantic Ocean, where Cape Verde and the broad part of Africa extend so much to the westward, and the northern part of Brazil, in America, to the East.

Small islands,* lying at a great distance from the main land, operate very little upon the trade wind. If elevated, these islands are more subject to rain than if low; this may be occasioned, principally, by the ascent given to the wind, or atmosphere, in rising over the tops of the hills; when, being cooled, it condenses into small, drizzly rain. This is an effect peculiar to all mountains, even in the middle of continents, when the atmosphere

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this idea.—(*Young's Lectures*, i. 704.) But it by no means follows, that this must always be the case. In general, a rapid transfer, either way, in latitude, of any mass of air which local or temporary causes might carry *above the immediate reach of the friction of the earth's surface*, would give a fearful exaggeration to its velocity. Wherever such a mass should strike the earth, a hurricane might arise; and should two such masses encounter in mid-air, a tornado of any degree of intensity on record might easily result from their combination."—*Astronomy*, p. 132. The more recent views of Sir John Herschel will be found in their place hereafter.

* "On a small plain which we crossed (near the centre of St. Jago, Cape Verde Islands), a few stunted acacias were growing; their tops, by the action of the steady trade wind, were bent in a singular manner, some even at a right angle to the trunk. The direction of these branches was exactly N.E. by N., and S.W. by S. These natural vanes must indicate the prevailing direction of the force of the trade wind."—*Darwin, Voyage of Adventure and Beagle*, vol. iii. p. 3.

is sufficiently charged with moisture. For the sun's rays, by heating the atmosphere according to its density, renders it much warmer at the bottom than at the top of hills. Upon a mountain, sloping from the sea toward the top, and about 700 yards in height, a pleasant breeze has been observed in-shore, and fine clear weather; but the air in ascending, being condensed by cold, at about halfway up had the appearance of fog, or thin light flying clouds; and at the top was a misty rain: this may frequently be seen in any mountainous country.*

The space from latitude 25° to 28° or 29°, between the variable and trade winds, is remarkable for a continual change of winds, with sudden gusts and calms, rain, thunder, and lightning. This space has been called the *Horse Latitudes*, because it has often been found necessary here to throw overboard the horses which were to be transported to the West Indies, &c. To the northward of these latitudes, upon the American coast, and more than one-third over the Atlantic, westerly winds prevail nearly nine months in the year.

In the latitudes above the trade winds the wind from the W.S.W.ward, being replete with moisture, from the great exhalation between the tropics, as it approaches the cold and higher latitudes, becomes condensed into showers of hail, rain, or snow. For instance, in the 50th degree of North latitude, the wind from the S.W. generally will prevail till the atmosphere is more condensed than in the lower latitudes; the wind from the colder region then ensues, and blows till the equilibrium of the atmosphere is restored, when a short calm generally succeeds before the wind shifts into another quarter.

There is often an interval of calm between the trade winds and the opposite winds in high latitudes. This is not, however, always the case; for, if the trade wind in its borders be much to the eastward, it frequently changes gradually round without an interval of calm. There is generally, also, a calm in a certain space between two prevailing winds, blowing in opposite directions, as between the trade wind and the westerly wind on the African coast. In the limits of the trade wind a dead calm is generally the prelude to a storm, and it ought always to be considered as a prognostic thereof.

When the sun is at its greatest declination, North of the Equator, the S.E. wind, particularly between Brazil and Africa, varying toward the course of the sun, changes a quarter or half a point more to the southward, and the N.E. trade wind veers more to the eastward. The contrary happens when the sun is near the southern tropic; for then the S.E. wind, South of the line, gets more to the East, and the N.E. wind, on the Atlantic, veers more to the North. In June, July, August, and September, while the sun is returning from the northern tropic to the Equator, the action of its rays upon the land and sea, in the northern part of the globe, renders the wind less constant by altering the state of the atmosphere.

On the African side the winds are nearest to the South, and on the American side, nearest to the East. In these seas Dr. Halley observed that, when the wind was eastward, the weather was gloomy, dark, and rainy, with hard gales of wind; but when the wind veered to the southward, the weather generally became serene, with gentle breezes, next to a calm.

The Equatorial Limits of the N.E. perennial or trade wind between the meridians of 18° and 26° West have been found, upon the comparison of nearly 400 journals, English and French, to vary considerably, even in the same months of the year. We have shown, on the Chart, where the N.E. trade, according to the probable mean, may be expected to cease in the different months: but the annexed Table will be found to answer the purpose more precisely.

In this Table the columns of *Extremes* show the uncertain termination of the trade winds, as experienced in different ships. The annexed columns show the *Probable* Mean; and the last column exhibits the mean breadth of the interval between the N.E. and S.E. winds.

Thus the Table shows that, in the month of January, the N.E. trade has been found sometimes to cease in the parallel of 10°, and sometimes in that of 3° N. That the probable mean of its limit is about 5° N. That the S.E. trade, at the same time, has been found to cease sometimes at only half a degree North of the line, and sometimes at 4°. That the probable mean of its limit is, therefore, 2½°. And that the interval between the assumed means of the N.E. and S.E. trade winds is equal to 2½°; and so of the rest.

* Oriental Navigator, or East India Directory.

TABLE SHOWING THE EQUINOCTIAL LIMITS OF THE N.E. AND S.E. TRADE WINDS, BETWEEN THE MERIDIANS OF 18 AND 26 DEGREES WEST.

N.E. TRADE WIND.			S.E. TRADE WIND.		INTERVAL BETWEEN.
CEASES.	General Extremes.	Probable Mean.	General Extremes.	Probable Mean.	Mean Breadth.
In January at	3° to 10° N.	5° N.	0½° to 4° N.	2¾° N.	2¼ degrees.
February	2 to 10 —	4 —	0½ to 3 —	1¼ —	3⅛ „
March	2 to 8 —	4¾ —	0½ to 2½ —	1¼ —	3½ „
April..............	2½ to 9 —	5 —	0 to 2½ —	1¼ —	3¾ „
May	4 to 10 —	6½ —	0 to 4 —	2½ —	4 „
June..............	6½ to 13 —	8½ —	0 to 5 —	3 —	5½ „
July	8½ to 14 —	11 —	1 to 6 —	3½ —	7½ „
August...........	11 to 15 —	13 —	1 to 5 —	3¼ —	9¾ „
September	9 to 14 —	11½ —	1 to 5 —	3 —	8½ „
October	7½ to 14 —	10 —	1 to 5 —	3 —	7 „
November	6 to 11 —	8 —	1 to 5 —	3 —	4¼ „
December	3 to 7 —	5½ —	1 to 4½ —	3¼ —	2¼ „

In the space of variable winds between the trades, exhibited in the last column, it has been found that southerly winds prevail more than any other, more particularly when the sun has great northern declination. Homeward-bound East India ships are therefore enabled, at this season, to cross the space more quickly than those outward bound; which they do, in some degree, at all other times. Yet calms and variable winds are experienced in every month of the year within this space; but the former, which are more generally in the vicinity of the N.E. trade, seldom continue long. These calms are frequently succeeded by sudden squalls; against which every precaution should be taken, as many ships have lost their topmasts, and have been otherwise damaged by them. Whirlwinds have sometimes accompanied these squalls in their first effort against the resisting atmosphere.

It has been stated as probable, that a gale of wind, or storm, never happens hereabout far from land, or near the Equator in the open ocean, on any part of the globe; although, in its vicinity, sudden gusts of wind and whirlwinds are sometimes experienced. S.W. and W.S.W. winds, with much rain, are frequent in July, August, and sometimes in June and September.

The heated land of Africa within Cape Verde, with the Cape Verde Islands, produce in the vicinity the variable winds, and occasional calms, which counteract the trade wind to a considerable distance from the coast. Hence it happens, that ships which approach too near the coast or islands, lose the trade wind sooner than those which keep at a greater distance. To guard against this, it has been recommended to commanders to keep well to the westward when the N.E. trade fails; but some, in observing this precept, have crossed the line too far to the West; for meeting with the S.E. trade, hanging far from the southward, with strong westerly currents, they have made the coast of Brazil, and been obliged, in consequence, to tack to the eastward.

It has been stated, and generally understood, that at the eastern end of the interval, between the N.E. and S.E. trade winds, there is a continual succession of calms, terrible thunder, lightning, waterspouts, and such frequent rains, that this portion of the ocean has been denominated THE RAINS. Ships have here, it is said, been detained for months, in passing between the latitudes of 10° and 4°. The cause appearing to be, that the westerly winds, setting for the coast, and the easterly winds, here balance each other, and produce the calms; while the vapours, meeting and condensing, produce the almost ceaseless rains.

The words of *M. La Pérouse* on his crossing the line, after passing Cape Verde, &c., are, in this place, worthy of especial notice. He says—"Nothing particular occurred during our passage to the line. The trade wind left us in 14° North, and the wind then constantly blew between West and W.S.W. till we reached the line, and obliged me to run down the coast of Africa, which I did at the distance of 60 leagues.

"We crossed the line on the 29th of September, 1785, in 18° West longitude (15° 40′ West of Greenwich). I could have wished, as my instructions were, to have passed it more to the westward; but, fortunately, the wind always drove us to the eastward, otherwise it would have been impossible to have made Trinidad,* the wind being S.E. at the line, and continuing so until we reached lat. 20° 25′ S.

"The dread, which some navigators entertain, of being, at this season, becalmed under the line, is founded on error. We were not a day without wind, and once only had rain; when, indeed, it was so abundant as to fill twenty-five casks.

"The fear of being driven too much to the eastward in the Gulf of Guinea is equally chimerical. The S.E. wind is soon met with, and even drives ships too rapidly to the westward; so that, had I been better acquainted with this navigation, I should have steered away more large with the S.W. wind, which constantly prevailed to the North of the line; and I should then have crossed it in the longitude of 10° (7° 40′ West of Greenwich). This would have permitted me to run, with a free wind, on the parallel of Trinidad. A few days after our departure from Teneriffe we left the serene skies of the temperate zones; instead of which a dull whiteness, between fog and cloud, always prevailed. The horizon was contracted; but, after sunset, the vapour was dissipated, and the nights were constantly fine."

Perhaps the most extensive collection of observations on the winds of the Atlantic is that embodied in the "Wind and Current Chart" of the Atlantic Oceans, by Lieutenant *M. F. Maury*, U.S.N., the superintendent of the National Observatory at Washington. The immense mass of materials here brought together it would be difficult to generalize in a limited space, or even to give a clear insight into their results without the aid of the chart. At a future day this may be done; at present we will limit our remarks to those given in the "Improved Sailing Directions" accompanying the above-named charts.

By examining and comparing together the records of several thousand sea journals to and from the Equator, it has been clearly shown that within the region of the N.E. trades there is a marked difference in the prevailing direction of the wind, not only according to the season of the year, but also according to different parts of the ocean, including even those parts which are between the same parallels of latitude, but in different longitudes.

As a general rule it may be remarked, 1st, that in the North Atlantic the nearer to the coast of Africa and the Equator, the more the so-called N.E. trade winds haul to the South.

2nd. That to the West of lon. 45°, between 20° and 30° W., the N.E. trades blow much more steadily in May, June, July, and September, than they do the rest of the year; and that during the other months, particularly in March, they blow between these parallels nearly alike from all points of the compass.

3rd. That between lat. 15° and 20° N. they are most variable; West of lon. 35° in the months of September, October, and November; while to the East of 30°, between the parallels, they are most variable in February, March, April, and October.

4th. That between lat. 10° and 15°, to the West of 35°, they are steadily between E.N.E. and S.E., except in July, August, September, October, and November, when they are more variable, being most variable in the three months first named. To the East of 35° W., between these parallels, they may be said to lose their trade character during the months of July, August, September, and October, particularly in August and September, when they blow nearly alike from the four quarters. Calms, too, are more frequent here in these months.

5th. That between the Equator and 10° N., to the East of lon. 30°, the winds assume a new feature. It may be said, almost literally, that in this part of the ocean they uniformly blow, when they blow at all, during the months of July, August, and September, from some point between S.E. and W. They blow most between S. and W.S.W., and very rarely from any point between N. and E.S.E. To the West of this meridian, during the same months, they blow most between S.E. and N.E., inclining more and more to the North as you go West. These are the months in which the winds vary most in this part of the ocean.

* The little Isle of Trinidad lying in lat. 20° 31′ S., lon. 29° 19′ W.

REMARKS ON THE WINDS AND CURRENTS TO THE NORTHWARD AND SOUTHWARD OF THE EQUATOR, BY CAPT. J. W. MONTEATH.

In the month of March, 1818, on leaving St. Antonio (Cape Verde Island), we shaped our course so as to cross the Equator on the meridian of 19° W. From that island the trade-wind continued steady from E. to N.E. until in the sixth parallel of latitude: from this to the fourth parallel the wind continued light from N.E. to N.: and to the second parallel, variable and squally, with heavy showers of rain. The current, between the third and second parallel, set S.E. by E. at the rate of 13 miles in twenty-four hours; and in lat. 1° 30′ N., set E.S.E. 10′ in twenty-four hours. Gained the S.E. trade in lat. 1° 30′ N., the wind from the S.S.E. to S.E.; between the parallels of 4° to 15° South, experienced a westerly current of 80 miles in five days.

I perfectly agree with M. Pérouse, that the dread which some navigators entertain of being becalmed in these parallels, and 19° West, is erroneous.

We were only about forty-eight hours without wind, from the parallel of 4° North to the time of gaining the S.E. trade; during which time we had abundance of rain; so much so, that we filled all our empty casks.

On my return voyage, in January, 1819, I crossed the Equator on the meridian of 20° 30′ West; we carried the S.E. trade until in the latitude of 4° 30′ North, at which parallel, in longitude 22° 30′ West, I found the current setting North by West at the rate of 1½ miles per hour.

This will point out the disadvantage of crossing the Equator on this meridian, as a vessel would be set to the northward, as fast as the light winds would carry her southward.

PERIODICAL WINDS, ETC.—Among the Canary Islands, northerly or N.E. winds mostly prevail; yet, being in the vicinity of the continent, westerly and southerly have been found to prevail there, sometimes for eight days successively.

During the months of November, December, January, February, and March, the winds from the East and N.E. are prevalent in the country between Cape Blanco and the entrance of the River Gambia. In this time the nights are cool; but scarcely has the sun arisen above the horizon, when the air becomes dry and parching. Nevertheless, these five months are the winter in this part of Africa, and this is the most healthy season. Between the Gambia and Cape Palmas the inland winds, during the same season, are variable.

In June, July, August, September, and October, the country situated between Cape Verga and Cape Mount is much exposed to hurricanes or tornadoes. These, however, do not occur in any part of the coast northward of Cape Verga.

From the 20th degree of North latitude to the environs of the line, the months of July, August, September, and October, are those of the rainy season, when the atmosphere emits its waters to the earth; the only difference is, twenty days sooner or later in the arrival of these torrents. During the other eight months in the year there does not fall a single drop of water.

On the African Coast, from Cape Blanco to Sierra Leone, the winds, at sea, excepting storms or land-breezes, have been stated to blow mostly rather from North to N.W. than from the North to the eastward.

Between the Cape Verde Islands, and in their neighbourhood, southerly and S.W. winds generally blow in July, August, September, and October. These islands, when the sun is in their zenith, are generally surrounded by thick fogs.

From Sierra Leone to Cape Palmas the ordinary course of the winds on the coast is from W.N.W., and beyond Cape Palmas, from W.S.W. to S.W. and S.S.W.

Although, in the Gulf of Guinea, the winds blow generally from the southward, and S.S.W. toward the coast, they take, in South latitude, a more westerly direction near the land, and then prevail from S.W. and W.S.W. between Cape Lopez and Benguela. But they veer proportionally more southerly as the distance increases from the coast.

Windward Coast, &c.—The name of *Windward Coast* has been given by our navigators to the whole of that coast which extends from Cape Mount to the River Assinee, where the Gold Coast commences: it includes the three particular coasts called, 1st, Grain or Pepper Coast; 2nd, Ivory or Teeth Coast; 3rd, the Coast of Adou, or Quaqua.

From January until May the weather here, along-shore, is commonly fair and clear, with cooling breezes, and gentle southerly winds. But, about the middle of May, South and S.E. winds begin, accompanied not only with hurricanes and stormy gusts, but also with thunder, lightning, and great rains, which continue, more or less, until the conclusion of the year.

On the Gold Coast, from Assinee to the River Volta, the wind, in January, begins to blow from the S.W. quarter, and becomes stronger in February, bringing with it sometimes rain, and sometimes a hurricane. About the end of March, and beginning of April, those heavy tempests, called by the Portuguese *tornadoes*, arise, accompanied with a deluge of rain, thunder, lightning, and sometimes with earthquakes; these continue to the end of May, and are announced by the darkness of the sky in the S.E.

During the rainy season, that is, in May and July, little or no land-winds are felt; but, from the sea, it blows from the S.W. and W.S.W., making a very great swell, which continues even in August, although the rains begin to cease in that month.

The weather becomes fair in September, and the air clear, with gentle South winds; and this continues till January, the hottest days being in December.

On the Gold Coast, as well as the windward coast, an easterly wind, called the *Harmattan*, prevails during the months of December, January, and February. This wind comes on indiscriminately, at any hour of the day, at any time of the tide, at any period of the moon, and continues sometimes only a day or two, sometimes five or six days, and it has been known to last fifteen or sixteen days. There are generally three or four returns of it in every season; it blows with a moderate force, not quite so strong as the sea-breeze, which every day sets in, during the fair season, from the West, W.S.W., and S.W.; but somewhat stronger than the land-wind, at night, from the North and N.N.W. In the *Philosophical Transactions*, vol. lxxi., for the year 1781, an account of the *Harmattan* was first given by *Matthew Dobson*, M.D., F.R.S., from the inquiries and observations of *Mr. Norris*, of which the following is the substance:—

" On that part of the coast of Africa which lies between Cape Verde and Cape Lopez, a singular periodical easterly wind, named, by the natives, the *Harmattan*, prevails during the months of December, January, and February. Cape Lopez lies to the southward of the line. At the Isles de Los, which lie to the northward of Sierra Leone, this wind blows from the S.S.E.; on the Gold Coast, from the N.E.; and at Cape Lopez and the River Gaboon, from the N.N.E.

" The Harmattan comes on as above described. A fog or haze always accompanies it, and the gloom is sometimes so great as to render near objects obscure. The sun is thus concealed the greatest part of the day, and appears only a few hours about noon, and then of a mild red colour. At 2 or 3 miles from shore the fog is not so thick as on the beach; and, at 4 or 5 leagues' distance, it is entirely lost, though the Harmattan is felt for 10 or 12 leagues, and blows fresh enough to alter the course of the current.

" Extreme dryness is a property of this wind. No dew falls during its continuance, nor is there the least appearance of moisture in the atmosphere. All vegetables are much injured, and many destroyed. The seams in the sides and decks of ships become very leaky, though the planks are 2 or 3 inches thick. Iron-bound casks require the hoops to be frequently driven tighter, and a cask of rum or brandy can scarcely be preserved; for unless kept constantly moistened, the hoops fly off. The Harmattan has, likewise, very disagreeable effects on the skin, lips, and nose, which become sore.

" The effects of the Harmattan in evaporation are great; as will appear by the following comparative statement:—At Liverpool, the annual evaporation is about 36 inches; at Whydah, 64 inches; but, under the influence of the Harmattan, 133 inches.

" This wind, though so prejudicial to vegetable life, is highly conducive to health; so that fluxes, fevers, small-pox, &c., generally disappear in spite of the doctor; and it contributes to the cure of ulcers and cutaneous eruptions. The baneful effects which have been said to arise from the prevalence of this wind proceed from the periodical rains, which fall in March, April, &c., and are ushered in by the tornadoes from the N.E. and E.N.E., accompanied with violent thunder and lightning, and very heavy showers. The earth, drenched by these showers, and acted upon by an intense solar heat, so soon as the storm is over, sends forth such noisome vapours as are the occasion of putrid fevers and other diseases.

" On this coast, from the middle of February to the first week in March, a wind up

the coast, from S.S.W. to S.S.E., prevails for about three weeks. The tornado season is part of March, all April, and the greater part of May, about twelve weeks. The rainy season is from the latter end of May, all June, and to about the 20th of July, about eight weeks. Hence, high wind, and squally, with very heavy rains, to the middle of August, about three weeks. The rain ceases, and then, for the first three weeks in September, the weather is foggy and close, without any breeze. From this time, for about six weeks, the wind blows fresh down the coast; the tornadoes and southerly wind then succeed, with some rain, generally called the *latter rains*, about four weeks, to the beginning of December, when the Harmattan season commences."

The prevailing winds in the western part of Africa and Gulf of Guinea are distinguished, by the natives, as follow:—

Aherramantii, or Harmattan, prevailing about ten weeks, from the 1st of December to the middle of February.

Inakera, a wind upon the coast from S.S.W. to S.S.E., from the first of March to the Equinox.

Pempina, the tornado season, from March until the end of May, about twelve weeks.

Abrenama, June and July, eight weeks, the rainy season, by the natives called the Old Man's, Woman's, and Children's season.

Atukogan. High winds and squalls, with heavy rains, to the middle of August, three weeks.

Worrobokoron. The rains cease, three weeks.

Mawarrah. Close foggy weather in September, three weeks.

Boutch. No land-breeze; the wind fresh down the coast for six weeks.

Antrophi. Frequent tornadoes southerly, some rain, called the latter rains, four weeks, continuing to the beginning of December, when the Harmattan commences.

REMARKS ON THE SEASONS AND WINDS WHICH PREVAIL ON THE COAST OF AFRICA, BETWEEN CAPE BOJADOR AND THE ISLES DE LOS; BY THE BARON ROUSSIN, 1817.

SEASONS.—On the whole extent of the African coast there are but two seasons; namely, the Rainy and Dry Seasons. The division of the two is connected with the periods when the sun crosses from one hemisphere to the other, and is modified as he advances to, or recedes from, the Equator.

THE RAINY SEASON.—The Rainy Season commences at each place on the coast to the northward of the Equator, at the time when the sun passes the zenith of that place in his course to the northward. It is, usually, during the mouth preceding this event, that the change of weather takes place. It may, therefore, be calculated, that, at the Isles de Los, the first point exposed to the rainy season, and which lie in 9½° N., the first violent squalls do not occur before the 10th or 15th of May: their arrival seems to be affected by the moon; for they almost always commence, and are most violent, on the days of the new and full.*

The Rainy Season ends in very violent squalls with intervals of calm, of which there are at least two, and frequently more, during the twenty-four hours; and we remarked, that they generally happen on the rising or setting of the sun or moon. In the country, these squalls are generally called *Tornadoes*, but according to the best information, the tornado, properly speaking, is to be met with only to the southward of Cape Verga. They generally begin to form themselves in the N.E. or E.N.E. quarter of the horizon, which seems completely on fire during an hour or more. The storm then gradually shifts round to E. and E.S.E., becoming darker in the horizon. Having arrived at S.E., it attains its full vigour, when thunder and lightning become incessant. A moment of absolute calm then takes place, which is caused by the obstruction which the usual winds from the N.W. meet with from this immense mass of clouds. Shortly after, a small arch

* See, further, upon this subject, our *Sailing Directory for the Ethiopic or Southern Atlantic Ocean*, Section the 6th.

is formed at the horizon, which increases and rises rapidly. The more defined the edge of this arch appears, the more violent will be the storm, as it is a proof that the column of air has divided much heavier clouds, and is more confined. When the summit of this arch has attained an altitude of about 45°, the hurricane bursts forth, and torrents of rain immediately follow. The crisis of its greatest violence generally lasts from 15′ to 20′; it afterwards gradually becomes weaker; and finally nothing remains but rain, attended with very little wind. It then shifts round from S.E. to W.S.W., then to the quarter from which the usual winds blow, to exhaust itself to the northward in another squall from the S.E.

The Rainy Season, at any place, continues from four to six months, according to its proximity to the Equator, and the tornadoes continue to decrease both in frequency and violence during the two latter months of the season. In ten days or a fortnight after the sun has passed the zenith of any place on his way to the South, it is considered as free from bad weather. On the 15th of November a gun is fired at Goree, which announces the return of the fine season.

The squalls here spoken of, and the winds which precede or follow them, generally occupying so very small a portion of the year, may be considered as momentary convulsions in a state of climate almost unchangeable; a sky nearly always serene, and generally clear.

On the greater part of the African coast, from Cape Bojador to the Isles de Los, regular winds blow, and no rain ever falls during eight months. The prevailing winds in this country blow from N.E. to N.W.; it may, therefore, be said, that they follow the direction of the coast from North to South, and that they seldom vary from the limits here assigned.

The Dry Season commences in the latter part of October at Senegal; a little later at Goree; and at each intermediate place toward the Equator it becomes gradually later. It is not till the beginning of December that its return is observed in the parallel of the Isles de Los.

THE HARMATTAN.—Although the winds from N.E. to N.W. prevail on the coast of Africa during the dry season, that is, from November to May, they are, nevertheless, occasionally interrupted between the 1st of December and the 1st February by the land-wind, which blows from E.N.E. to E.S.E., and sometimes with violence.

It is this wind which the inhabitants of the country call the *Harmattan*. It comes on at different periods in the above interval, and blows during one, two, and sometimes five or six successive days. This continuance, however, is rare, as it is generally interrupted by the sea breezes, which commence about noon, after a calm of one or two hours. These alternate land and sea breezes generally last till the end of February, when the usual winds entirely prevail. The Harmattan, which passes over the most arid country of the globe, is of an extremely dry nature, and would probably become insupportable, were it not frequently allayed by the sea-breezes above mentioned. Notwithstanding the salutary effect of these breezes, the drought is astonishing, so long as the Harmattan lasts. Mankind are inconvenienced; vegetables suffer so much as to be nearly killed; the sun loses his brilliance, and is only to be seen when near noon; the sand, brought with it from the desert, pervades the atmosphere, and prevents objects from being distinguished at the distance of a quarter of a mile. Nevertheless, the effect of the Harmattan is not really injurious to health; it is remarked, that it even purifies the atmosphere, by destroying the noxious vapours with which it is replete on the conclusion of the rainy season. It is usually on the return of the Harmattan, that recovery commences from disorders which are incident to the climate.

The fog which accompanies the Harmattan loses nothing of its density when 3 leagues out at sea. On the edge of the Bank of Arguin, which is 10 leagues from the land, it prevented our distinguishing the horizon during three successive days. This state of the atmosphere is not permanent, but varies with the winds which produce it; and, in general, independent of the Harmattan, the African coast, from Cape Bojador to Cape Verde, is continually covered, during the whole dry season, with a white mist, which is seen from the sea much sooner than the land, of which it is a sure indication. This mist, which is nothing but sand, the extreme fineness of which allows of its being supported by the least agitated air, is particularly remarkable on that part of the desert between the parallel of 22° and Senegal. We have seen it at the distance of 5 leagues, when the coast could scarcely be seen at 3 leagues.

GENERAL REMARKS MADE ON THE COAST BETWEEN THE ISLES DE LOS AND SIERRA LEONE, BY CAPTAIN T. BOTELER, OF H.M.S. *HECLA*, 1829.

The HARMATTAN SEASON sets in with November, or about a month earlier than off the Gambia, and prevails through December and part of January, but not quite constantly; for occasional intervals of clear weather, accompanied by the refreshing sea-breeze from the N.W., sometimes afford a respite to its oppressive effects. Nor does the Harmattan blow uniformly, either in the same direction, or with the same strength; for it ranges through eight points of the compass, from N.N.E. to E.S.E.; and, however fiery at the commencement, declines, after the first month, to a comparatively light breeze.

The PECULIAR HAZE which more or less envelopes the coast of Africa at all times, is at its maximum during the influence of the Harmattan; and, though partially dispersed by the tornadoes and the rainy season, returns with increased density when they cease. Strangers should, therefore, be on their guard when estimating their distance from the land, as the deceptive effect of this haze makes it appear much farther off than it really is; for the contrast which the coast presents to the eye, in different states of the atmosphere, is very great. In clear weather the view of the fertile shelving hills in the Isles de Los, the stupendous features of the distant mountains, the plains covered with trees, and the beautiful little Island of Matacong (described hereafter), are highly interesting; while in hazy weather, nothing is visible but a low mangrove coast, enveloped in mist, with an indistinct opening of a river here or there, or perhaps a column of smoke rising from a native village.

The RAINY SEASON continues for four months, from May to September; but the *tornadoes*, which invariably accompany its commencement and termination, generally cease between those periods. They blow from the E.S.E., and with great fury; but they seldom last more than three hours. The prevalent winds, during the rest of the rainy season, are from southward and westward, and are usually so light as to give way in the afternoon to the N.W. sea-breeze.

TORNADOES on the AFRICAN COAST, as described by M. Golberry.—" Between Cape Verga and Cape Palmas, and during the months of May, June, July, August, September, and October, the countries near the sea are frequently exposed to hurricanes, which the Portuguese have denominated *tornadoes*, and which have obtained this name even among the Negroes. During my stay in the River of Sierra Leone I witnessed one of these tornadoes, but it was not one of the most violent. These meteors happen a few weeks before the rainy season, and continue till the month of November. The countries above described are, therefore, exposed to them for nearly six months; and these whirlwinds are more or less frequent, and of different degrees of violence, according to the state of the atmosphere.

" This part of Africa generally experiences ten or twelve of these hurricanes in a year; and it is easier to describe their effects than to discover their cause. They are characterized by circumstances which deserve all the attention of philosophers.

" The sky is clear, a perfect calm has prevailed for several hours, and the weight of the air is oppressive. Suddenly, in the most elevated region of the atmosphere, is perceived a little round and white cloud, the diameter of which does not appear to exceed 5 or 6 feet: this cloud, which seems to be fixed and perfectly motionless, is the indication of a tornado.

" By degrees, and at first very gradually, the air becomes agitated, and acquires a circular motion. The leaves and plants, with which the land is always covered, rise several feet from the soil; they keep incessantly moving and revolving around the same spot.

" The Negroes, who pass their lives like children, amuse themselves with this rotary motion; they follow the turn of the agitated leaves and plants, laugh at their innocent amusement, and announce the approach of the tornado.

" The cloud, which is the indicator of this phenomenon, has now increased in size: it continues to spread, and insensibly descends to the lower region of the atmosphere; at length, it grows thick and obscure, and covers a great part of the visible horizon.

" By this time the whirlwind has increased, the vessels in the bays double their cables,

or drop anchor near the shore; the tornado becomes violent and terrible; the cables often break, and the violent agitation of the ships causes them to run foul of each other.

"Many Negro huts are swept away, trees blown up by the roots; and when these whirlwinds exert their full violence, they leave deplorable traces of their progress. These meteors happily last only a quarter of an hour, and terminate by a heavy rain.

"The maritime countries to the northward, comprised between Cape Blanco and Cape Verga, are not subject to these phenomena; it is only to the South of the latter cape, and as far as that of Palmas, that they are felt in their full violence; and they always occur at the same periods. Some topographical circumstances, peculiar to this part of Western Africa, are, doubtless, among the number of causes of these whirlwinds.

"Between the tenth and twentieth degrees of latitude, North, and between the eighth degree of longitude (from Greenwich) and the Atlantic Ocean, there is no spot of ground sufficiently elevated to deserve the name of a mountain. Western Africa begins to be mountainous at Cape Verga, and it continues to rise to the summit of the chain, which bears the name of Sierra Leone: these summits may be considered as the most elevated points of this part of Africa; and its topographical configuration then presenting eminences which form an obstacle to the course of the winds, and depths in which they may be ingulfed, must contribute to produce such phenomena."

Other topographic descriptions, by M. Golberry, will be found in the following section of this work.

WINDS ON THE ATLANTIC ISLES.—The winds upon and near the different islands in the Atlantic Ocean are very variable and uncertain, especially where the land is high and irregular. In general, regular sea and land breezes alternately prevail; the sea-breeze by day, and the land-breeze by night, as the land is alternately heated and cooled: but the direction of these breezes is varied by the quality and figure of the land, and other local circumstances. If the land be very high, it generally intercepts the prevailing wind, and so affects the air as to produce, on the lee-side, either a calm, a gentle breeze in an opposite direction, or a kind of eddy, which is sometimes very troublesome to shipping. Such is the case under the western part of Madeira, and to leeward of the Canary Islands; the Grand Canary being so high as to stop the current of the N.E. wind, which prevails there; and on the eastern side there is a calm, or a gentle breeze from S.W.

The calms and eddy winds, occasioned by the figure and height of the Canaries, extend from 10 to 30 leagues beyond them to the S.W., according to the height of the respective islands. The boundary of the calms may be seen: for, within them, the water is smooth; without them is the regular undulation of the sea, caused by the general wind; and, at the edge of them, the winds, by setting in opposite directions, produce a breaking of the waves, with a foam, like the billows on a rocky shoal, just beneath the surface of the ocean.

From a consideration of the particulars now described, the cause of those copious dews which fall in the night, on the islands, &c., situated within the tropics, will be apparent. For, as the great power of the sun by day causes an extraordinary evaporation of the ocean, so, in the night, the exhalation, ceasing to retain the same degree of levity acquired from the heat of the sun, becomes, by the absence of the power which produced it, so dense and heavy, as again to fall back to the earth. The air, at the same time, cooling, by the same cause, is also affected by the descending moisture, and thus acquires an additional tendency to increase the land-breeze.

According to Sir Humphry Davy's theory of mists, land and water are cooled after sunset in a very different manner:—The impression of cooling on the land is limited to the surface, and is very slowly transmitted into the interior; whereas, in water, the upper stratum, when cooled, descends, and has its place supplied by warmer water from below. The surface of the water will, therefore, in calm and clear weather, and temperatures above 45° of Fahrenheit, be warmer than the contiguous land; and, consequently, the air above the land will be cooler than that above the water. When the cold air, therefore, from the land mixes with that above the water, both of them containing their due proportion of aqueous vapour, a mist or fog must be the result.

In the CENTRAL PART of the OCEAN, between the Azores and West India Islands, Mr. Luccock was passing homeward from Brazil, in the year 1816; and, in his *Notes*, he says—"In this neighbourhood, about lat. 29° N., and lon. 38° W., I felt the

greatest degree of cold which I ever experienced; or, to express myself more correctly, I never knew a ship's company so susceptible of the *change* of temperature as there. It was the 3rd of April, 1816. We had passed the Equator on the preceding 20th of March. In our run to the northward, the wind had been easterly and the weather hot. The N.E. trades were undoubtedly blowing between us and the coast of Africa, and we were now approaching their northern verge. It was, therefore, natural to suppose that we had suddenly entered into that section or current of air which had recently passed over the mountains of Atlas, probably at that early period of the year still covered with snow. If this conjecture be right, it shows that the frosts of these African mountains produce a very sensible degree of coldness at the distance of 1,300 miles from them; that the scorched desert also has warmed the atmosphere to the same extraordinary distance from the coast; and that the two lines of the aerial current have run parallel to, and almost without intermingling with, each other."

JAMAICA.—At JAMAICA the air is, in most places, hot and unfavourable to European constitutions; but the cool sea-breezes, which set in every morning, render the air more tolerable: and that upon the high grounds is temperate, pure, and cooling. It lightens almost every night, but without much thunder: nevertheless, when the latter happens, it is very terrible, and roars tremendously.

On the southern side of the island the sea-breeze from the south-eastward comes on in the morning, and gradually increases until noon, when it is strongest: at two or three in the afternoon its force diminishes; and, in general, it entirely ceased by five o'clock. About eight in the evening the land-breeze begins: this breeze extends to the distance of 4 leagues to the southward from the island. It increases until midnight, and ceases at about four in the morning.

The sea and land breezes are more regular than otherwise from the latter part of January until May. In the middle of May the sea-breeze generally prevails for several days and nights, especially about the time of full and change of the moon; and thus they continue throughout June and part of July; from that time the sea-breeze diminishes, varies, and veers round to S. by W., or S.S.W., with frequent calms. August, September, and October, are the hurricane months, in which there generally are strong gales of wind, with much rain.

In December, January, and February, when the North winds predominate, their force checks the sea-breeze. The southern coast is that which, of course, is least exposed to these winds, being sheltered, in a great measure, by the mountains. When combined with the land-breeze, they render the air very cold and unhealthy.

During the months of July and August the sea-breeze about the island generally blows impetuously, and in frequent squalls. At this season vessels bound hence to Europe would have the most advantageous passage through the Strait and Stream of Florida; but, in October, northerly winds frequently extend over all the Bahamas, Cuba, and, for some time, on the North side of Jamaica; but the current of air is forced upward by the mountains of the latter, and its strength is spent in the heights. In seasons when it is more impetuous, it rushes through the windings and defiles of the mountains upon the northern coast, particularly in the neighbourhood of Kingston, and has been known to continue for some days.

During the winter, the land-breeze is more general off the shores than in summer: it sometimes continues throughout the day as well as night; and westerly winds prevail over all the space between Jamaica and Cuba, and even to the Island of Hayti or St. Domingo. They have been experienced from Port-Royal, through the Windward Channel; but this is not generally the case.

In November, southerly winds prevail on the South side of the island, and have been known to extend from the Mosquito shore, whence vessels have arrived in five or six days, that might, at other times, have been as many weeks, when beating against the sea-breeze. The southerly winds are generally faint; nor do they come upon the land until it be heated by the sun, and are often expelled by a fresh land-breeze soon after mid-day, which abates in a few hours.

The return of the sea-breeze, falling sooner or later in autumn, is gradual: first approaching the East end, then advancing a little; and, in some years, it reaches Morant Point fourteen or twenty days before it is felt above Kingston. It also blows for a week or two later on the East end of the island than at Kingston; and has been known, in

some years, to prevail there in the day time during the whole time it was unfelt at the former place.

Notices of various other local winds on the American Coasts, &c., may be found in the particular descriptions given hereafter.

WEST INDIES IN GENERAL.—The following description of the winds prevailing over these regions, in the different seasons, has been extracted chiefly from Captain Livingston's translation of the *Derrotero de las Antillas*, or Spanish Directory for the West Indies, now included in the *Colombian Navigator*.

"On the eastern coasts of America, and among its islands, the course of the general easterly or trade-wind is uninterrupted, though subject to some modifications in direction and force. At a short distance from the land the sea-breeze calms at night, and is replaced by the land-breeze: this variation happens every day, unless a strong wind prevails from the northward or southward; the first of these being experienced from *October* to *May*, and the second in *July*, *August*, and *September*.

"The general easterly wind, of the tropical regions, is felt on the coast of Guyana and on the coasts of the Colombian and Mexican Seas, but with variations which may be denominated *diurnal* and *annual*. The diurnal period is that which the *sea-breeze* causes, and which strikes the coast usually at an angle of two points, less or more according to the locality and other circumstances; and then the *land-wind*, which, coming from the interior, always blows off shore. The sea-breeze comes on at about nine or ten in the forenoon, and continues while the sun is above the horizon, increasing its force as that luminary augments its altitude, and diminishing in a similar proportion, as the sun's altitude decreases. Thus, when the sun is on the meridian, the sea-breeze is at the maximum of its strength; and at the time that the sun reaches the horizon, this breeze has, perceptibly, ceased. The land-breeze commences before midnight, and continues until the rising of the sun; sometimes longer. A space of some hours intervenes between the land-breeze ceasing and the sea-breeze coming on, during which there is a perfect calm.

"The *annual period* of the trade-wind here is produced by the proximity or distance of the sun, which occasions the only two seasons known in the tropics, the *rainy* and the *dry* seasons. The first is when the sun is in the tropic of Cancer, and heavy rains with loud thunder are prevalent. In this season the wind is generally to the southward of East, but interrupted by frequent calms, yet it occasionally blows with force, and obscures the atmosphere.

"When the sun removes to the tropic of Capricorn, the dry season commences, and then the trade-wind, which is steady at N.E., is cool and agreeable. At this season, N. and N.W. winds are sometimes found, blowing with much force; and, indeed, in some degree, they regularly alternate with the general wind, as they are more frequent in November and December, than in February and March.

"In the change of the seasons there is a remarkable difference: for, in April and May, no change is experienced in the atmosphere, and the weather is, in general, beautifully fine; but in August, September, and October, there are usually calms, or very light winds: and dreadful hurricanes, in these months, sometimes render the navigation perilous. From these perils, however, are generally exempted the Island Trinidad, the coasts of Colombia (late Terra Firma), the Bays of Darien and Honduras, and the Bight of Vera Cruz, which the hurricanes seldom reach. In the space of sea between the greater Antillas,* and the coast of Colombia, the general N.E. or trade-wind regularly prevails: but, near the shore, local peculiarities are found."

It has been remarked, by *Captain F. Chamier*, of the British Navy, that "about BARBADOES and the WINDWARD ISLANDS, from Tobago to Barbuda, the wind will be found to veer more to the northward in the early part of the year, than in the months of June, July, and August. In the more northerly islands, as Dominica, Montserrat, Antigua, Nevis, &c., the wind, in the evenings of January, February, and March, veers round to about N. or N.N.E.; blows very fresh in squalls; and, from the extensive space of ocean over which it travels, becomes cool and very refreshing. The thermometer, even in English Harbour, Antigua, in the above months, at eight o'clock p.m., I never saw above 76°. In this season of the year the sickness of the hot months is no longer experienced; the general lassitude of the mornings and noons of July and August seems

* Cuba, Jamaica, Hayti, and Porto-Rico.

forgotten; and no man who visited these islands during the first three months of the year, would believe that the change of seventy or eighty days could make such an amazing difference in the look, as well as in the energy, of the inhabitants of the Windward Islands. In the change of seasons, from wet to dry, a great difference is experienced in the winds. In April and May the atmosphere is, in general, clear, and fine weather prevails; but in August, September, and October, calms, or very light winds, are not uncommon, and strong hurricanes blow in these months.

"At the GREATER ANTILLAS the sea-breeze constantly prevails by day, and the land-breeze by night. These land breezes are the freshest which are known, and assist vessels much in getting to the eastward or remounting to windward, which, without them, would be almost impossible. At the Lesser Antillas, as Dominica, Martinique, St. Lucia, &c., there are no land-breezes."

Among the local winds are to be ranked the BAYAMOS, violent gusts which blow from the land on the South side of Cuba, and are so termed from being felt more severely off the Bight of *Bayamo* or *Buena Esperanza*, than off any other part of the coast.

These squalls, which are very tremendous, have been experienced by several ships of the British Navy, but particularly by the *Drake* sloop and the *Pique* frigate: the latter having lost some of her masts.

"When heavy and dense clouds gather over the mountains, a Bayamo blast may be expected: after this, the surest prognostic is the thunder, which invariably precedes the gust; it is, therefore, advisable to take in all sail, with the greatest expedition, so soon as the first or most distant clap of thunder is heard, the wind following it almost immediately. Fortunately, however, these dreadful squalls are of short duration; but, as a repetition of them frequently occurs at intervals of half an hour or an hour, great attention is necessary, especially during the night, to prevent the ship's being unprepared; as it is almost certain that, if she were overtaken by one of these squalls, whilst under sail, she would either upset or lose her masts.

"These sudden tempests are attended with sheet and forked lightning, vivid in the extreme; and the flashes, following each other in quick succession, have the momentary effect of illuminating every object, and leave behind them a sort of blue indescribable appearance; the sea is whitened with foam, and the rain falls in torrents, surpassing any, perhaps, witnessed in other regions; for it appears as if the clouds had opened their store of waters to deluge the earth: in fact, we cannot better describe the extreme heaviness of the shower, than by giving the sailor's observation on it, namely, that it 'comes down by buckets full.' The Bayamo squall, however, although the most awful of any in the Caribbean Sea, and creating much anxiety to those exposed to his fury, is grand and sublime."—*Lieutenant Evans*, "Revision of Geographic Terms," p. 107.

"On the COASTS of GUYANA," the *Derrotero* again continues, "there are no land-breezes, nor more wind than is generally experienced between the tropics. In January, February, and March, the winds here blow from North to E.N.E., and the weather is clear. In April, May, and June, the winds are from East to S.E. In July, August, and September, there are calms, with tornadoes from South and S.W.; and in October, November, and December, there are continual rains, while the sky is, in general, obscured by clouds. In the dry season, which is from January to June, the heat is very great; and in the wet season, from August to November, rains and thunder are constant and violent.

"On the COASTS of CUMANA and CARACCAS, to Cape la Vela, the breeze follows the regular course; but from that cape to Cape San Blas the general wind alters its direction; for it blows from N.E. or N.N.E., excepting in the months of March, April, May, and June, when it comes to E.N.E., and is then so uncommonly strong as to render it necessary for vessels to lie-to. These gales, which are well known to mariners, extend from about mid-channel to within 2 or 3 leagues of the coast, where they become weak, especially at night. On this coast, about the BAY of NICARAGUA, are westerly winds, which the pilots of that country call *Vendavales* (rainy winds), in the months from July to December; but these winds never pass the parallel of 13° N., nor do they blow constantly, but alternate with the sea-breeze.

"Upon the MOSQUITO SHORE, HONDURAS, and EASTERN COAST of YUCATAN, the general winds or breezes prevail in February, March, April, and May; but, during the first two of these months, they are occasionally interrupted by *Norths*. In June, July, and August, the winds here are from the eastward and westward of South, with

tornadoes and calms. In September, October, November, December, and January, they are from the northward or southward of West, with frequent gales from W.S.W., W.N.W., and North.

"On the NORTHERN and WESTERN COASTS of YUCATAN, between Cape Catoche and Point Piedras or Desconocida, and thence to Campeché, there is no other than the N.E. or general wind, interrupted by hard Norths in the season of them; and, about the end of April, tornadoes commence from N.E. to S.E. These tornadoes generally form in the afternoon; continue about an hour; and, by nightfall, the serenity of the atmosphere is re-established. The season of the tornadoes continues until September, and in all the time there are sea-breezes upon the coast, which blow from N.N.W. to N.E. It has been remarked that, as the breeze is more fresh, the more fierce is the tornado, especially from June to September. The sea-breezes come on at about eleven of the day; and at night the wind gets round to E.N.E., E.S.E., or S.E., so that it may be, in some degree, considered as a land-breeze.

"On the COAST of the MEXICAN SEA, from VERA CRUZ to TAMPICO, the breeze from E.S.E. and East prevails in April, May, June, and July; and, at night, the land-breeze comes off from South to S.W.: but if the land-breeze is from the N.W., with rain, the wind, on the day following, will be from North, N.N.E., or N.E., particularly in August and September: these winds are denominated, in the country, *Vientos de Cabeza o Vendovales* (head winds or rainy winds); they are not strong, nor do they raise the sea: with them, therefore, a vessel may take an anchorage as well as with the general breeze; but they impede getting out, for which the land-breeze is required. The *Vientos de Cabeza*, or head-winds, reach to about 20 or 30 leagues from the coast, at which distance are found those at East and E.S.E.

"From the middle of September until the month of March caution is necessary in making VERA CRUZ, for the Norths are then very heavy. The narrowness of this harbour, the obstruction formed by the shoals at its entrance, and the slender shelter it affords from the Norths, render an attempt to make it, during one of them, extremely dangerous, for it will be impossible to take the anchorage. The following description of the winds here has been written by Don Bernardo de Orta, a captain in the Spanish Navy, who has been captain of the port, and who surveyed it.

"Although in the Mexican Sea it cannot be said that there is any other constant wind than the general breeze of this region, yet, from September to March, the North winds interrupt the general course, and, in some degree, divide the year into two seasons, *wet* and *dry*, or of the *Breezes* and *Norths*: the first, in which the breezes are settled, is from March to September; and the second, in which the Norths blow, is from September to March. For greater clearness, we shall explain each separately.

"The first of the Norths is regularly felt in the month of September; but, in this month and the following one, October, the Norths do not blow with much force. Sometimes it happens that they do not appear; but, in that case, the breeze is interrupted by heavy rains and tornadoes. In November the Norths are established, blow with much strength, and continue a length of time, during December, January, and February. In these months, after they begin, they increase fast; and in four hours, or a little more, attain their utmost strength, with which they continue blowing for forty-eight hours; but afterward, though they do not cease for some days, they are moderate. In these months the Norths are obscure and north-westerly, and they come on so frequently, that there is, in general, not more than four or six days between them. In March and April they are neither so frequent, nor last so long, and are clearer, but yet they are more fierce for the first twenty-four hours, and have less north-westing. In the interval before November, in which, as we have said, the *Norths* are established, the weather is beautiful, and the general breeze blows with great regularity by day; the land-breeze as regularly by night.

"There are various signs by which the coming on of a *North* may be foreseen: such are, the wind steady at South; the moisture of the walls, and of the pavements of the houses and streets; seeing clearly the Peak of Orizaba and the Mountains of Perote and Villa Rica, with the cloud on those of St. Martin, having folds like a white sheet; the increase of heat and of dew; and a thick fog, or low scud, flying with velocity to the southward: but the most certain of all is the barometer; for this instrument, in the time of the Norths at Vera Cruz, does not vary more, between its highest and lowest range, than 0·8; that is to say, it does not rise higher than 30·6 inches, nor fall lower than

29·8 inches. The descent of the mercury predicts the Norths; but they do not begin to blow the moment it sinks, which it always does a short time before the North comes on: at these times lightnings appear on the horizon, especially from N.W. to N.E.; the sea sparkles; cobwebs are seen on the rigging, if by day: with such warnings trust not to the weather, for a North will infallibly come on.

"This wind generally moderates at the setting of the sun; that is, it does not retain the same strength which it had from nine in the morning to three in the afternoon, unless it commence in the evening or at night, for then it may increase. Sometimes it happens that, after dark, or a little before midnight, it is found to be the land-wind, from the northward and westward; in which case, should it get round to the southward of West, the North will be at an end, and the general breeze will, to a certainty, come on at its regular hour: but, if that does not happen at the rising of the sun, or afterward, and at the turn of the tide, it will return to blow from the North, with the same violence as on the day before, and then it is called a *Notre de Marea*, or *Tide North*.

"The Norths also sometimes conclude by taking to the northward and eastward, which is more certain; for if the wind in the evening gets to N.E., although the sky remain covered the day following, but by night the land-breeze has been from the northward and westward, the regular breeze will surely ensue in the evening, good weather succeeding and continuing for four or six days; the latter period being the longest that it will last to, in the season of the Norths: but, if the wind retrograde from N.E. to N.N.E. or North, the weather will be still unsettled.

"Examples are not wanting of Norths happening in May, June, July, and August, at which times they are most furious, and are called *Notres del Hueso Colorado;* the more moderate are called *Chocolateros*, but these are rather uncommon.*

"The Wet Season, or Season of the Breezes, is from March to September: the breezes at the end of March, and through the whole month of April, as already explained, are, from time to time, interrupted by Norths, and are from E.S.E., very fresh; the sky sometimes clear, at other times obscure. At times these touch from S.E., and continue all night, without giving place to the land-breeze, which prevails, in general, every night, excepting when the North wind is on. The land-breeze is freshest when the rains have begun.

"After the sun passes the zenith of Vera Cruz, and until he returns to it, that is, from the 16th of May to the 27th of July, the breezes are of the lightest description, almost

* From Lieut. *John Evans* (a), R.N. (a gentleman to whom we are indebted for many valuable communications), we have received the following description of a *North* in the Mexican Sea, which occurred in March, 1828.

"We had observed, during our run over the Catoche Bank, a very extraordinary white hazy-like appearance, very distinct from the common fog, haze, or mist; this was seen principally in the northern quarter, and attracted much notice; the air, at the same time, 'breathing gently at South,' and the sympiesometer falling unusually low, gave us strong indications of an approaching *North*. On the 15th there appeared on the sky only a few small *cumuli* and dark *strati;* in the morning the air was very light from the South, and was so warm, or rather hot, and oppressive, that, like the *sirocco*, it affected the breathing of some of us. At ten a.m. it changed to the N.E. with fine weather, the wind gradually freshening: at sunset the *cumuli* changed into dark *nimbus*, of a deep purple, edged with a bronze colour: from these clouds proceeded squalls with rain, the wind veering from N.E. to N.N.W., after which it cleared up, the clouds all dispersed, and at eight p.m. a fresh North came on, with a rapidly rising sea (which a short time before had been perfectly calm and smooth). The sympiesometer fell to 29·80, which was lower than it had ever done before. It blew a gale all night, with a heavy sea; no clouds; the stars bright and large. The same white hazy-like appearance took place before the North set in. Early in the morning of the 16th the wind died away suddenly, almost to a calm; and at eight a.m. became a moderate breeze."

In describing his voyage to Tampico, in 1825, Mr. *Beaufoy* makes the following remarks on the exhalation and climate of the Mexican Sea.—"The dew, which fell from a clear blue starlight sky, not only wetted the deck and rigging, but penetrated through a thick great coat; and the scorching heat of the sun only rendered the dampness of the shade more uncomfortable, though the thermometer stood at 86 degrees.

"A storm of thunder and lightning, but without rain, such as I had never before witnessed, gratified not a little my expectations of the marvellous: crash followed crash, or murmured slowly along, amid the airy mountains which bounded the horizon: while balls of fire burst like volcanoes among the heavy masses, seeming to threaten destruction to earth and heaven."

calms, with much mist or haze, and slight tornadoes. After that time, the pleasant breezes from N.W. to N.E. sometimes remain fixed.

"From the 27th of July to the middle of October, when the Norths become established, the tornadoes are fierce, with heavy rains, thunder, and lightning: those which bring the heaviest winds are from the East, but they are also those of the shortest duration.

"In the Season of the Breezes, the total variation of the barometer is 0·4; the greatest ascent of the mercury is to 30·36 inches, and its greatest descent to 29·96 inches. The thermometer in July rises to 87°, and does not fall to 83½°: in December it rises to 80½°, but never falls below 66½°. This, it must be understood, was ascertained in the shade, the instrument being placed in one of the coolest and best ventilated halls in the castle.

"In the months of August and September, rarely a year passes without hurricanes near Florida and the Northern Antillas; but to Vera Cruz, or any part of the coast thence to Campeché, they never arrive; all that is felt being the heavy sea, which has arisen in the higher latitudes. Hurricanes begin to the northward and eastward; and, although they do not always go round the same way, yet, in general, they next go to the southward and eastward, with thick squally weather and rain."

From TAMPICO to the BAY of SAN BERNARDO, breezes, from the southward and eastward, are steady and pleasant from April to August; but, in the remaining months, this coast is much exposed to gales from East and E.S.E., which blow, without intermission, for two or three days, before a North comes on. In about latitude 26½°, there are land-breezes in the summer, which blow from midnight until nine in the forenoon.

From the BAY of SAN BERNARDO to the MISSISSIPPI there are land-breezes (*Madrugada*) in the early part of the morning, but after daylight the wind comes to S.E. or E.S.E., and generally, in the evening, it is from the S.W. In winter the South winds are most stormy, and blow for two or three days together. The most dangerous months for navigating these seas are August, September, October, and November, in which there are hurricanes and traverse winds (winds blowing dead on shore), which are so heavy that a vessel under them cannot carry sail. Upon the Mississippi, and all about its entrance, fogs are thick and frequent; particularly in February, March, and April.

From the Mississippi to the parallel of 28° the breezes from the northward and eastward, or southward and eastward, prevail in the mornings of the months from April to July, and in the afternoon the wind changes to S.W. These are called the *Virazones*, or *Turnings*. There are storms in August, September, and October, the season in which also are the strongest Souths and hurricanes. From November to March the Norths prevail; they begin at S.E. and South, with much rain; pass to S.W. and West, whence they blow with much force, and remain until they chop round to N.W. and North, after which the weather becomes serene.

From the gulf, in the parallel of 28°, to the Eastern Kays of Florida, the breezes or general winds prevail until mid-day, when the sea-breeze sets in during the summer; but, in the winter, and especially from November till March, the winds are from the southward and eastward, and raise much sea.

In the Strait of Florida the breezes are the prevailing winds, but they are interrupted by Norths in the winter, and by calms in summer. Although the northern limit of this channel is within the boundary of the breezes, or trade-wind, it is necessary to remember that, in winter, or from November to April, the variable winds from the southward and eastward, and southward and westward, are met with in lat. 27°, and even before: and in summer, from May until September, the winds in the whole channel are variable from the southward and eastward, and southward and westward.

NORTH AMERICA.—WINDS ON THE NORTH AMERICAN COASTS.—To the southward of Newfoundland, shifts of winds are very common, and it frequently happens that, after blowing a gale upon one point of the compass, the wind suddenly shifts to the opposite point, and blows equally strong. It has been known that while one vessel has been lying-to, in a heavy gale of wind, another, not more than 30 leagues distant, has, at the very same time, been in another gale, equally heavy, and lying-to, with the wind in quite an opposite direction.*

* Mr. Redfield has shown, that this statement is to be understood as applicable to two vessels falling under the two opposite sides or portions of the same storm, where the wind, in *its circuit of* rotation, must blow from opposite quarters of the horizon, as explained hereafter.

In the year 1782, at the time the *Ville de Paris*, *Centaur*, *Ramillies*, and several other ships of war, either foundered or were rendered unserviceable, on or near the banks, together with a whole fleet of West Indiamen, excepting five or six, they were all lying-to, with a tremendous gale from E.S.E. or S.E. by E., which thus continued until at last it shifted suddenly into a violent squall from N.N.W., or more westerly, and every ship lying-to, under a square course, foundered.*

The winds within the gulf are not so liable to sudden shifts as on the outside, or to the eastward of Breton Island. The weather to the southward of the *Magdalen Islands*, between them and Prince Edward Island, is generally much clearer than on the North.

GULF AND RIVER OF ST. LAWRENCE.—Captain Bayfield states that, during the navigable season, the prevailing winds are either directly up or directly down the estuary of St. Lawrence, following the course of the chains of high lands on either side of the great valley of the river. Thus a S.E. wind in the gulf becomes E.S.E. between Anticosti and the South coast, E.N.E. above Point de Monts, and N.E. above Green Island. The westerly winds do not appear to be so much guided in direction by the high lands, excepting along the South coast, where a W.S.W. wind at the Isle Bic has been seen to become West, W.N.W., and N.W., on running down along the high and curved South coast, until it became a N.N.W. wind at Cape Gaspé. These winds frequently blow strong for three or four days in succession; the westerly winds being almost always accompanied with fine, dry, clear, and sunny weather; the easterly winds as frequently with the contrary, cold, wet, and foggy. In the spring the easterly winds prevail most; frequently blowing for several weeks in succession. As the summer advances, the westerly winds become more frequent, and the S.W. wind may be said to be the prevailing wind in summer, in all parts of the river and gulf. Light South winds take place occasionally; but North winds are not common in summer, although they sometimes occur. Steady North winds do not blow frequently before September, excepting for a few hours at a time, when they generally succeed easterly winds which have died away to a calm, forming the commencement of strong winds, and usually veering to the S.W. The N.W. wind is dry, with bright clear sky, flying clouds, and showers. After the autumnal equinox, winds to the northward of West become more common, and are then often strong, steady winds of considerable duration. In the months of October and November the N.W. wind frequently blows with great violence, in heavy squalls, with passing showers of hail and snow, and attended with sharp frost.

Thunder-storms are not uncommon in July and August; they seldom last above an hour or two, but the wind proceeding from them is, in general, violent and sudden, particularly when near the mountainous part of the coast; sail should, therefore, be fully and quickly reduced on their approach.

Strong winds seldom veer from one quarter of the compass to another directly or nearly contrary; in general, they die away by degrees to a calm, and are succeeded by a wind in the opposite direction. It is not here meant, that they may not veer to the amount of several points. N.W. winds seldom veer round by North and N.E. to East and S.E., but they do frequently, by degrees, to the S.W., after becoming moderate. S.W. winds seldom veer by the N.W. and North to the eastward, but sometimes by the South to S.E. and East. Easterly winds generally decrease to a calm, succeeded by a wind from the opposite direction.

In the fine weather westerly winds of summer a fresh top-gallant breeze will often decrease to a light breeze or calm at night, and spring up again from the same quarter on the following morning: under these circumstances only may a land-breeze off the North coast be called for. The same has been observed off the South coast also, but not so decidedly, nor extending so far off shore. Captain Bayfield adds—" I have occasionally carried the North land-wind nearly over to the South coast just before daylight, but have never observed the South land-wind extend more than 5 or 6 miles off, and that very rarely. Under the same circumstances, that is, with a fine weather westerly wind going down with the sun, a S.W. land-breeze will frequently be found blowing off the North

* The *Ramillies*, of 74 guns, bearing the flag of Rear-Admiral T. Graves, was, with other ships of the line and convoy, on her passage from Jamaica toward England, and, having been rendered unserviceable by the weather, was burnt on the banks of Newfoundland, September 21. From the same reason, the *Hector*, 74, Captain Bourchier, was sunk on the banks, October 5. The *Centaur*, 74, Captain Inglefield, foundered in the ocean, and only twelve persons were saved; and the *Glorieux*, 74, is supposed to have foundered, having never since been heard of.

coast of Anticosti at night and during the early part of the morning. If, however, the weather be not settled fair, and the wind does not fall with the sun, it will usually prove worse than useless to run a vessel close in shore at night in the hope of a breeze off the land. Such is the usual course of the winds in common seasons, in which a very heavy gale of wind will probably not be experienced from May to October, although close-reefed top-sail breezes are usually common enough. Occasionally, however, there are years, the character of which is decidedly stormy. Gales of wind, of considerable strength, then follow each other in quick succession, and from opposite quarters." The marine barometer, which is at all times of great use to the navigator, becomes particularly so in such seasons, as shown in the *Appendix* hereafter.

UNITED STATES.—Winds on the Coast of South Carolina, &c.—*Remarks by Mr. George Walker.*—About this coast, if the wind blows hard from the N.E. quarter, without rain, it commonly continues so for some time, perhaps three or four days; but, if such winds are attended with rain, they generally shift to the East, E.S.E., and S.E. S.E. winds blow right in on the coast; but they seldom blow dry, or continue long: in six, eight, or ten hours after their commencement, the sky begins to look dirty, which soon produces rain. When it comes to blow and rain very hard, you may be sure the wind will fly round to the N.W. quarter, and blow hard for twenty or thirty hours, with a clear sky.

N.W. winds are always attended with clear weather; they sometimes blow very hard, but seldom for longer than thirty hours. The most lasting winds are those which blow from the S.S.W. and W.N.W., and from the North to the E.N.E. The weather is most settled when the wind is in any of these quarters.

In summer-time, thunder-gusts are very common on this coast; they always come from the N.W. quarter, and are sometimes so heavy, that no canvas can withstand their fury: they come on so suddenly, that the greatest precaution is necessary, to guard against the effects of their violence.

Of the thunder-gusts, Captain Walker has said:—The first indication of them is a black heavy cloud, the weather sultry, little wind, and variable. I advise, at the appearance of these warnings, not to stay to reef, but clew up every sail, except the fore-sail and fore-topmast stay-sail, and your ship will be ready to veer; if you have time to hand the sails clewed up, do it, but it seldoms happens that you have, as these gales come on suddenly. A shocking accident happened to a brigantine in company with me, off Cape Hatteras, in the year 1773: a little before the squall reached them, they attempted to reef, and, in the time of reefing, the vessel overset, and all perished.

The same gentleman, in his description of the coast in the vicinity of St. Augustin, has stated:—From the 1st of November to the last of February, the hardest gales prevail that blow on this coast; and in general from the N.N.E. to the S.S.E., the wind any way easterly comes on very suddenly to a gale during the season above mentioned; and these gales give but very little warning. In the year 1777, I had the charge of his Majesty's ship the *Lively*, and was then at anchor in St. Augustin's Bay, when it came on to blow at E.N.E., and in fifteen minutes' time I was obliged to slip, and, had we not carried sail to the utmost, we should not have cleared the land to the southward.

When the wind backs against the sun, with a small rain, you will perceive the sea to rise before the wind comes; then prepare for a gale, which, in general, will last fifty or sixty hours. If you should be obliged to cut or slip, carry all the sail you possibly can, to get an offing before it increases so as to put you past carrying any sail, which is always the case; and observe, that the flood tide setting to the southward will be of no service to you farther out than in 12 fathoms of water, when you will be in the southern current until you get into 46 fathoms, which is about 15 leagues from the land. Then you will be in the Gulf Stream, issuing out of the Strait of Florida, and which runs strongly all along the edge of soundings.*

To the preceding description of the winds on the American Coasts may be added the incidental remarks of *Captain Hare*, giving in the Directions for *Passages to North America*, hereafter. The latter, founded on actual experience, tend to show that the N.W. and westerly gales commence in the southern regions before they are felt in

* Directions for proceeding to and from the ports of America, with adverse winds, will be found in the Directions for making the Passages, hereafter.

those more northerly; and that, therefore, a northern route is, in certain cases, perferable to one more direct or southerly.

On the North-East Storms of North America, *Dr. Franklin* made some remarks in 1760, in which he gives his reasons for thinking that they begin first, in point of time, in the S.W. parts; that is to say, the air in Georgia begins to move south-westerly before the air of Carolina, which is the next state north-eastward: the air of Carolina has the same motion before the air of Virginia, which lies still more north-eastward; and so on north-easterly through Pennsylvania, New York, New Hampshire, &c., quite to Newfoundland. These N.E. storms, he adds, are generally very violent, continue sometimes two or three days, and often do considerable damage in the harbours along the coast. They are attended by thick clouds and rain.

The Doctor illustrates his hypothesis with his usual felicity; and concludes with saying:—" Thus, to produce our N.E. storms, I suppose some great heat and rarefaction of the air in or about the Gulf of Mexico; the air thence rising has its place supplied by the next more northern, cooler, and therefore denser and heavier, air; that, being in motion, is followed by the next more northern air, &c., &c., in successive current; to which current our coast and inland ridge of mountains give the direction of N.E., as they lie N.E. and S.W."—See *Works*, vol. ii. p. 63; Edition of 1809.

Colonel Reid says—" At New York the labouring people remark that, if the haze indicating a storm be first seen over Staten Island (on the S.W.), the wind will come from the *N.E.;* but if the haze be seen over the Jersey shore of Hudson River (or westward), then the wind will come on from the *S.E.* It is also said to be a seaman's phrase that a *North-wester* will never remain long in debt to a *South-easter;*" and these observations are supported by experience.

It has been remarked that, at the same place, " In four successive years the westerly winds have been found to be to the easterly nearly as two to one. Observations on the courses of the clouds for the same period show the prevalence of an atmospheric current from the westward, at that elevation, to be, as compared with those from the eastward, nearly as fourteen to one; the prevailing wind being south-westerly. At Montreal, in Canada, as appears by the observations of J. M'Cord, Esq., the westerly surface winds also appear to exceed the easterly, in the proportion of more than four to one." Hence it is that the passages of the fastest ships, from Europe to America, are found to occupy a much longer period than from America to Europe.*

Progressive Winds, when they have an opposite wind to subdue, are frequently preceded many hours by a swell, which extends a great way before them.

OF HURRICANES IN GENERAL.

Among the most extraordinary phenomena of nature, may be classed those tremendous meteors, the hurricanes and tornadoes of the tropical regions. Until within a recent period they were very imperfectly understood, and were only regarded as terrible convulsions of the aerial system, when all order seemed to be broken up. But these, like many other apparent anomalies in nature, have been found reducible to system; and their various seemingly capricious motions all subject to general rules, which, in this case, have been aptly denominated '*The Law of Storms.*'

The recent discussions on the *progressive* nature of hurricanes appear to have originated in a paper, entitled '*Remarks on the Prevailing Storms of the Atlantic Coast of the North American States, by William C. Redfield, of the City of New York;*' which has proved to be a very important and valuable addition to nautical literature. The subject, adopting the '*Redfield Theory,*' has since been amplified and illustrated by Lieutenant-Colonel (now Sir) William Reid, R.E. and C.B., since Governor of the Bermudas and of Malta, in his beautiful volume, bearing for the title, '*An Attempt to Develop the Law of Storms by means of Facts, arranged according to Place and Time, and hence to point out a Cause for the Variable Winds, with a view to practical use in Navigation,*' &c. As connected with this subject, the names of Redfield and Reid will be imperishable.†

* " Meteorological Sketches by an Observer;" *American Journal of Science and Arts,* vol. xxxiii.

† " My attention was first directed to the subject from my having been employed at Barba-

We say that the discussion appears to have originated in the before-mentioned works; but, without deciding on the claims of priority, it must be mentioned that, besides the names of Reid and Redfield, those of Mr. Piddington at Calcutta, Dr. Thom in the Indian Ocean, of Mr. Espy in America, and of Professor Dové, at Berlin, must be enrolled with them, as the primary instigators of the inquiry into the origin and nature of storms.

Before proceeding to the consideration of the effects of these terrors to the mariner, and the description of the laws by which they appear to be governed, we may premise that our knowledge of their origin, or of the causes which produce them, is very imperfect; and it is reserved for future investigations in meteorology to point out the nature of the great atmospheric changes which induce such tremendous effects.

In our introduction to the description of the Winds, &c., page 97, we gave the theory that has been universally received as the cause of the trade-winds and their attendant phenomena in the general atmospheric currents. In a practical work like the present, it is, perhaps, irrelevant to enter into theoretic disquisitions; but, as the subject requires practical elucidation, we have entered more largely into the subject.

Mr. Redfield objects to the commonly received theory of calorific rarefaction in the equatorial regions, upon several grounds. First, that the difference of temperature in inter and extra tropical zones is inadequate for the cause; secondly, that the rising of the body of the trades has never been confirmed; thirdly, that the line of perpetual snow on mountains will not coincide with the theory; fourthly, that the semi-annual change of the sun from North to South latitude is not accompanied by an equal change in the position of the trades; and fifthly and sixthly, that there are many systematic winds which cannot be made to agree with that system. He argues for a general system of *horizontal revolution*. Without inquiring here into the merits or demerits of these cases, we recommend the attention of the mariner to the different phenomena which may be met with in the tropical regions; and these observations, if transmitted to those who will embody them into a system, will add materially to the benefit of navigation.

The first general remarks we shall make will be upon the constitution of the atmosphere. From the number of Meteorological Observatories that have been lately established, we now have a tolerably correct notion of the usual phenomena of the aerial envelope of the earth.

The atmosphere always contains an amount of *aqueous vapour*: this, in its usual state, is undistinguishable by ordinary means; and when any disturbance takes place in the constitution of the air, this aqueous vapour becomes evident to the senses in the form of rain, dew, &c.; but it is always present, in a greater or less degree, and, by refined investigation, its amount and weight are ascertainable.

The quantity of air above any place is perfectly measured by that simple instrument, the *barometer*. As we ascend, of course the atmosphere becomes less dense; and at a certain height it is entirely lost; this height of the atmosphere is determined by the distance at which the centripetal overcomes the centrifugal force. It is therefore erroneous to suppose that the atmosphere becomes at last of such tenuity as to pervade all space. This height of the atmosphere is perfectly represented by the mercurial column in the barometer, which may be taken as a reduction of that amount, the ratio being the difference between the weight of mercury and of atmospheric air.

In estimating the height of the barometer, the pressure due to the aqueous vapour is to be taken into consideration; and from an immense number of observations, the following results have been arrived at:—As the temperature increases, the *force of the wind* becomes higher, and the pressure of aqueous vapour becomes less, and these three phenomena are, in a remarkable manner, coincident; but it is also most remarkable that, while the temperature increases, and the force of the wind becomes greater, *the barometer falls*—that is, the *amount of the superincumbent atmosphere becomes less*, so that the maximum of temperature, and of the force of the wind, is exactly coincident with the least pressure of the aqueous vapour and of the atmosphere.

We have entered into this, not only because it seems to us to confirm, in some mea-

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does in re-establishing the Government buildings blown down in the hurricane of 1831; when, from the violence of the wind, 1,477 persons lost their lives in the short space of seven hours. I was induced to search everywhere for accounts of previous storms, in the hope of learning something of their causes and mode of action.—*Reid, 'Law of Storms,'* p. 1. This work is illustrated with ten large charts, besides other engravings.

sure, the original theory of the circulation of the winds, but also because it serves to explain a portion of the effects of the atmosphere upon that most important instrument to the mariner, the *Barometer*, or its perhaps more useful substitute, the Simpiesometer.

We may here again advert to the theory proposed on pp. 116, 117, that these revolving storms may be caused by a portion of the upper currents of air (if they exist), and which, according to that system, would cross the surface winds at right angles, or to the N.E. and S.E.; that a portion of these upper currents, by electrical influences or otherwise, should, with their immense equatorial velocity, descend into, and combine with, the lower strata, and thus form those tremendous vortices.

It has been again supposed that these storms and volcanic eruptions have some degree of connexion; but for this there does not appear to be any reason—at least, from our present knowledge.*

The atmosphere is, without doubt, subject to the same laws of gravitation with other fluids; and therefore it is to be inferred that there will be tides in the atmosphere, as in the ocean, though there can be no similarity in their effects, from the great difference in their circumstances.

Sir John Herschel and Mr. Birt, in investigating the observations† made at the different Meteorological Observatories that have been established in various parts of the world, have arrived at the conclusion that there are, at times, *barometric waves*, or undulations, in the atmosphere, of immense extent: these have been denominated Barometric Waves, from their being made evident by the fluctuations of the barometer, which, as was before described, exhibits perfectly the weight, and therefore the quantity, of air above the station. One of these waves has been traced as extending from the Cape of Good Hope, through intermediate stations, to the Observatory at Toronto, in Canada, under the superintendence of Lieutenant-Colonel Sabine. As an explanation of the origin of the rotary storms under consideration, Sir John Herschel has proposed the idea, that two or more of these extensive atmospheric undulations, or barometric waves, may, from traversing in different directions, *intersect* each other, and from their opposing forces, cause the phenomena of hurricanes and rotary storms.

From all the investigations on the subject, the following conclusions have been arrived at. The hurricane, or rotary storm, commences within the tropics, on either side of the Equator; *those in North latitude, the motion of the revolving circle is from right to left, past the North, or against the sun:* while the storm progresses to the W.N.W., N.W., North; forming a cycloidal curve in about 30° N. lat., and runs off to the N.E.

South of the Equator, or in the southern hemisphere, *this rule is reversed, the storm revolving from left to right*, and passing onwards in a S.W., and finally in a S.E. course.

The diameter of these circular vortices varies from 40 or 50 to even 1,000 miles, probably increasing in size in their onward progress. Their rate of travelling varies from 3 to 50 miles per hour.

There are numerous minor peculiarities connected with these CYCLONES (so named from their spiral formation) which will be gathered from the subsequent remarks. But the great point with the mariner is to avoid their fury, and, having ascertained their character and his relative position on the meteor, to make the best course for getting away from it. Colonel Sir William Reid's "Law," is simple, and will be best given in his own words.

Colonel Sir W. Reid's rule for laying ships to in Hurricanes.—That tack on which a ship should be laid-to in a hurricane has hitherto been a problem to be solved, and is one which seamen have long considered important to have explained.

In these tempests, when a vessel is lying-to, and the wind veers by the ship's head, she is in danger of getting stern-way, even when no sail is set; for in a hurricane the wind's force upon the masts and yards alone will produce this effect should the wind veer ahead, and it is supposed that vessels have often foundered from this cause.

When the wind veers aft, as it is called, or by the stern, this danger is avoided, and a ship then comes up to the wind, instead of having to break off from it.

* Should this be the case, it is curious, that near to where the lines of the courses of the hurricanes would terminate, if continued to the Equator, is that region of submarine volcanoes which we have shown to exist between lon. 18° and 21° W., in the neighbourhood of the Equator.—See *Ethiopic Memoir*, pp. 80—83.

† See Report of the British Association, 1843 44.

If great storms obey fixed laws, and the explanation of them in this work be the true one, then the rule for laying a ship to follows like the corollary of a problem already solved. In order to define the two sides of a storm, that side will be called the right-hand semicircle which is on the right of a storm's course, as we look in the direction in which it is moving, just as we speak of the right bank of a river. The rule for laying a ship to will be, *when in the right-hand semicircle to heave-to on the starboard tack, and when in the left-hand semicircle to heave-to on the port tack in both hemispheres.**

We shall first give descriptions of the most remarkable of these storms, as detailed by Colonel Sir W. Reid, Mr. Redfield, and others, for the illustration of which, the Chart showing the courses of various hurricanes, at the commencement of this work, is given; and then show the means of avoiding the danger, and the indications of their approach; and also how to apply their power to the service of navigation, and shorten the passages by making proper use of them.

Routes on the Chart.—No. I. Trinidad to Yucatan, over the middle of the Caribbean Sea, June 23 to 28, 1831.

No. II. Barbadoes to the Mississippi, August 10 to 17, 1831.

No. III. Guadaloupe to the Bank of Newfoundland, August 17 to 29, 1827.

No. IV. Guadaloupe and Antigua to Charlestown, and thence to the Bay of Fundy, September 3 to 10, 1804.

No. V. Antigua, passing over Cuba, to the coast of Texas, August 12 to 18, 1835.

No. VI. Barbuda to Charlestown, and thence to the Bank of Newfoundland, August 12 to 19, 1830.

No. VII. From the intersection of 20° North and 60° West (N.E. of Barbuda), passing to the West of Bermuda, and thence N.E. to the parallel of 42½°, September 29 to October 2, 1830.

No. VIII. From the parallel of 22° (North of Porto-Rico) to Cape Hatteras, to the coast of Maine, September 1 to 5, 1821.

No. IX. From near the same spot as No. VIII., on a similar route, but more to the eastward, August 22 to 27, 1830.

No. X. From the parallel of 30° North, on the East side of the Florida Stream, to Cape Sable of Nova Scotia, January 13 to 16, 1831.

No. XI. Inland storm, over the lakes, and thence to the Gulf of St. Lawrence, November 10 to 12, 1835.

The route designated as No. I. is that of the hurricane which visited the Islands of Trinidad, Tobago, and Granada, on the 23rd of June, 1831. Pursuing its course through the Caribbean Sea, it was subsequently encountered by H.M. schooner *Minx*, and other vessels, and its swell was thrown with great force upon the south-eastern shores of Jamaica on the 25th, while passing that island, where the wind at this time was light from the northward. After sweeping through the Caribbean Sea, the hurricane entered upon the coast of Yucatan, on the night of the 27th, having moved over the entire route from Trinidad to the western shore of the Bay of Honduras, in a little more than 100 hours, a distance of nearly 1,700 miles, equal to 17 miles an hour.

Track No. II. is that of the hurricane which desolated Barbadoes in the night of the 10th of August, 1831; and which passed Porto-Rico on the 12th; Aux Cayes, in Hayti, and S. Iago de Cuba, on the 13th; Matanzas on the 14th; was encountered off the Tortugas on the 15th; in the Mexican Sea on the 16th, and was at Mobile, Pensacola, and New Orleans on the 17th; a distance of 2,000 miles in about 150 hours, exceeding 13½ miles an hour. Its course, until it crossed the tropic of Cancer, was nearly W.N.W. Mr. Redfield adds—"In pursuing its northern course, after leaving the ocean level, it must have encountered the mountain region of the Alleganies, and was perhaps disorganized by the resistance opposed by these elevations. It appears, however, to have caused heavy rains in a large extent of country north-eastward of the Mexican Sea."

Track No. III. is that of the destructive hurricane which swept over the Windward Islands, 17th August, 1827; visited St. Martin and St. Thomas on the 18th; passed the N.E. coast of Hayti on the 19th; Turks' Islands on the 20th; the Bahamas on the 21st

* "An Attempt to Develop the Law of Storms," 3rd edition, 1850, p. 509; and "The *Progress*, &c., of the Law of Storms and of Variable Winds," 1849, p. 25.

and 22nd; was encountered on the coast of Florida and South Carolina on the 23rd and 24th; off Cape Hatteras on the 25th; off the Delaware on the 26th; off Nantucket on the 27th; and off Sable Isle and Bank on the 28th. Its ascertained course and progress were nearly 3,000 miles in about eleven days; or at the average rate of about 11 miles an hour. The direction of its route, before crossing the tropic, nearly N. 61° W., and in lat. 40°, while moving eastward, N. 58° E.

Track No. IV. An extensive hurricane of September, 1804, which swept over the Windward Islands on the 3rd of that month; the Virgin Islands and Porto-Rico on the 4th; Turks' Islands on the 5th; the Bahamas and the Strait of Florida on the 6th; the coast of Georgia and the Carolinas on the 7th; Chesapeake and Delaware, with the continuous portions of Virginia, Maryland, and New Jersey, on the 8th; and the States of Massachusets, New Hampshire, and Maine, on the 9th; being on the high lands of New Hampshire a violent snow-storm. The destructive action of this storm was widely extended on both sides of the track indicated upon the chart, and the same fact pertains in a greater or less degree to the other storms herein mentioned. It appears to have passed from Martinique and the other Windward Islands to Boston, by the usual curvilinear route, in about six days; a distance of more than 2,200 miles, at an average progress of about 15½ miles an hour.

Track No. V. The route of the hurricane which ravaged Antigua, Nevis, and St. Kitt's, in the afternoon and night of August 12, 1835; St. Thomas, St. Croix, and Porto-Rico, on the 13th; Hayti and Turks' Islands on the 14th; the vicinity of Matanzas and Havanna on the 15th; was encountered off the Tortugas, on the Bank of Florida, on the 16th; in lat. 27° 21′, lon. 94°, and other points on the 17th and 18th; and at Matamoras, near the Mexican shore, lat. 26° 4′, on the 18th, where it was most violent during the succeeding night. It also passed over Galveston Bay, in Texas, and there blew with violence from the S.E.; while at the mouths of the Mississippi and along the northern shores of the gulf, the gale was not felt. This storm is remarkable, as moving more directly and farther to the West, than is usual for storms which pass near the West Indian Islands, it having reached the Mexican shores before commencing its sweep to the northward. Course, about N. 73° W.: progress more than 2,200 miles in six days; nearly equal to 15½ miles an hour.

Track No. VI. The memorable gale of August, 1830, described hereafter, which, passing close by the Windward Islands, visited St. Thomas on the 12th, was near Turks' Islands on the 13th; at the Bahamas on the 14th; eastern coast of Florida on the 15th; coasts of Georgia and the Carolinas on the 16th; off Virginia, Maryland, New Jersey, and New York on the 17th; off George's Bank and Cape Sable on the 18th; and over the Newfoundland Bank on the 19th; having occupied about seven days in its ascertained course from near the Windward Islands, a distance of more than 3,000 miles; the rate of its progress being equal to 18 miles an hour. If, adds Mr. Redfield, we suppose the actual velocity of the wind, in its rotary movement, to be five times greater than this rate of progress, which is not beyond the known velocity of such winds, it will be found equal, in this period, to a rectilinear course of 15,000 miles. The same remark applies, in substance, to all the storms which are now passing under review.

Track No. VII. was encountered to the northward of the Caribbee Islands on the 29th of September, 1830; its route was to the eastward of all those previously described, and was found on the Grand Bank of Newfoundland, October 2, having caused great damage and destruction, on its widely-extended track, to the many vessels which fell in its way. The ascertained route may be estimated at 1,800 miles, and the average progress 25 miles an hour.

Track No. VIII., experienced in September, 1821, as more fully shown hereafter. This hurricane was extremely violent; it was encountered to the north-eastward of Turks' Islands, on the 1st of the month; to the northward of the Bahamas and near the latitude of 30° on the 2nd; on the coast of the Carolinas early in the morning of the 3rd; and from thence, in the course of that day, along the coast of New York and Long Island; and it is represented to have continued its course across the States of Connecticut, Massachusets, New Hampshire, and Maine. The diameter of the storm appears to have exceeded 100 miles; its ascertained route and progress about 1,800 miles in sixty hours, equal to 30 miles an hour.

A similar but less violent storm swept along the same portion of the coast of the United States on the 28th of April, 1835.

Track No. IX. The route of a violent and extensive hurricane, which was encountered to the northward of Turks' Islands, August the 22nd, 1830; northward of the Bahamas on the 23rd; and off the coast of the United States on the 24th, 25th, and 26th of the same month. It produced much damage, but scarcely reached the American shores. Its duration was about forty hours, and progress more tardy than some others.

Track No. X. A violent hurricane and snow-storm, which swept along the American coast from the parallel of 30° North, on the 5th and 6th of December, 1830. This track corresponds to another storm of similar character, which swept along the coast on the 13th, 14th, and 15th of January, 1831. These violent winter storms exhibited nearly the same phases of wind and general characteristics as those which appear in the summer and autumn.

Track No. XI. The violent inland storm which passed over the Lakes Erie and Ontario on the 11th of November, 1835. This storm was very extensive, spreading from the sea-coast of Virginia into the Canadas, to a limit unknown. The anterior portion of this gale was but moderately felt, and its access was noted chiefly by the direction of the wind and the great fall of the barometer: the violence of the storm being exhibited chiefly by the posterior and colder portion of the gale, as is common with extensive overland storms. The regular progression of the storm, in an easterly direction, was established by facts collected by Mr. Redfield, from the borders of Lake Michigan to the Gulf of St. Lawrence and the coasts of New England and Nova Scotia.

In perusing the descriptions above, it is to be noted that the lines on the Chart representing the routes, are given by Mr. Redfield as but approximations to the centre of the track or course of the several storms; and the gales are to be considered as extending their rotative circuit from 50 to 300 miles or more, on each side of the delineations; the superficial extent of the storm being estimated both by actual information and by its duration at any point near the central portion of its route, as compared with its average rate of progress.

The circular figure which appears upon the Chart, on Tracks Nos. I., V., and VII., will serve, in some degree, to illustrate the course of the wind in the various portions of the superficies covered by the storm, and also to explain the changes in the direction of the wind, which occur successively at various points, during the regular progress of the gale.

HURRICANES of 1780.—From want of adequate information on the subject, it was formerly assumed that the memorable hurricane of the year 1780, which dispersed and destroyed nearly all the British fleet in the West Indies, took its course from W.N.W. to E.S.E.; but from authentic documents, acquired by Colonel Reid, it has been shown that two great storms occurred nearly at the same time, and these have been frequently confounded together, and considered but as one. The first destroyed the town of Savanna-la-Mar, on the 3rd of October, 1780. The second, and by far the greater one, passed over Barbadoes on the 10th and 11th of the same month, as will be shown hereafter.

The first or *Savanna Hurricane* appears to have progressed from the S.E. to the western part of Jamaica, and thence passed in a N.N.E. direction over Cuba, the Great Bahama Bank, and Island of St. Salvador, continuing nearly in the same direction to the parallel of 35° N., in lon. 69° W., whereabout its ravages probably ceased. Between the 5th and 7th of October, it annoyed the squadron under Rear-Admiral Rowley, between the parallels of 28° and 29½°, lon. 72½° to 75°,* previous to which, at half-past five in the morning of the 4th, the *Phœnix* frigate, under Sir Hyde Parker, was driven on shore and wrecked at about 3 leagues to the eastward of Cape Cruz, Cuba. At eleven p.m. of the 2nd, the ship was off Port Antonio, Jamaica, when the wind began to blow, with a stormy appearance to the eastward, and she then close-reefed her topsails. At eight a.m. of the 3rd, the wind was E.N.E., with occasional heavy squalls; and Sir Hyde remarked that the *weather had the same appearance as he had observed in the commencement of a hurricane in the East Indies.* He then ordered the topsails to be taken in, and wore the ship, in order to keep mid-channel between Jamaica and Cuba.

At two p.m. the *Phœnix* lay-to, with a storm mizen staysail, and her head to the northward. When night set in, the storm increased with great violence. At midnight the wind was S.E., and the ship drawing upon Cuba, the captain proposed to wear her, but no canvas could withstand the wind at this time, and under the direction of the first lieutenant, Archer, she was wore by sending 200 of the crew into the fore-rigging. When

* Marked * in the Chart.

about to cut away the masts, the ship took the ground, and if she had not been driven on shore she must have foundered. All the ship's company were saved, excepting twenty, most of whom were lost with the main-mast, and washed overboard.

Of the ships in Rear-Admiral Rowley's squadron, above mentioned, on the 6th and 7th of October, the *Hector*, *Berwick*, *Bristol*, *Trident* and *Ruby*, were disabled, and mostly dismasted. They had been sent by the Admiral, Sir Peter Parker, to convoy a fleet part of the way to Europe, and had subsequently the misfortune, in the same month, to meet the great hurricane, next described.

The Savanna hurricane seems to have originated within the Caribbean Sea, and not to have passed over the Eastern Antillas, nor touched on the continental coast to the southward. The *Scarborough* frigate, which was lying a few days before in Montego Bay, was lost, and it is supposed that she foundered near the western end of Jamaica.*

The Great Hurricane, which commenced at Barbadoes on the 10*th of October*, 1780,† was preceded in the evening of the 9th by weather remarkably calm, but the sky surprisingly red and fiery, and during the night much rain fell. The storm approached from the S.E., and the ships of the squadron stationed here experienced the hurricane, each in turn, according to the place she was in. A letter from Dr. Blane, dated from the *Sandwich*, Sir Geo. Rodney's flag-ship, stated that it was not previously apprehended that there would be anything more than such a gale as they experience, from time to time, at that season; but, on the evening of the 10th, the wind rose to such a degree of violence as clearly to amount to what is called a *hurricane*. At eight p.m. it began to make impression on all the houses, by tearing off the roofs, and overthrowing some of the walls. As the inhabitants had never been accustomed to such a convulsion of nature, they remained for some time in security, but they now began to be in the utmost consternation. * * * * It was thought to be at its greatest height at midnight, and did not abate considerably until eight next morning. During all this time, most of the inhabitants had deserted their houses, to avoid being buried in the ruins; and every age, sex, and condition, were exposed in the fields to the impetuous wind, incessant torrents of rain, and the terrors of thunder and lightning. Many were overwhelmed in the ruins, either by clinging for shelter too long in the buildings, or attempting to save what was valuable, or by unavoidable accidents in the fall of walls, roofs, and furniture, the materials of which were projected to great distances. Even the bodies of men and cattle were lifted off and carried above the ground. From an estimate of the number of deaths reported to the governor, they amounted to more than 3,000. All the fruits of the earth were destroyed; most of the trees torn up by the roots, and many of them stripped of their bark. The sea rose so high as to destroy the fort, carrying the great guns many yards from the platform, and demolishing the houses near the beach. A ship was driven on shore against one of the buildings of the naval hospital, which, by this shock, and by the impetuosity of the wind and sea, was entirely destroyed and swept away. * * * * The mole-head was swept away; and ridges of coral rock were thrown up to above the surface of the water: but the harbour and roadstead were, upon the whole, improved, having deepened in some places 6 feet, in others many fathoms. The crust of coral, which had been the work of ages, leaving a soft oozy bottom, and many shells and fish were found ashore which had been previously unknown.

The hurricane passed, in succession, over the Islands of St. Vincent, St. Lucia, Martinique, and Dominica, and included within its area those of Guadaloupe, St. Christopher, St. Eustatius, &c. At St. Vincent, every building was blown down, and the town destroyed. At St. Lucia, which was near the centre of the hurricane, all the barracks and other buildings were blown down and the ships driven to sea. At Martinique, likewise, all the ships that had brought troops and provisions were blown off the island. On the 12th, four ships with their crews foundered in Fort Royal Bay. The other ships were blown out of the roads. In the town of St. Pierre, on the N.W. coast, every house was blown down, and more than 1,000 people perished. At Fort Royal, the cathedral, seven churches, other religious edifices, many public buildings, and 1,400 houses, were blown down, as was the hospital of Nôtre Dame, in which were 1,600 sick and wounded, the greatest part of whom were buried in the ruins. The number of persons who perished in

* Colonel Reid, "Law of Storms," pp. 276—283, and Chart ix. The colonel, as in other cases, adds copious details, which plainly show where the hurricane did not operate, either to the East or to the West.

† The track of this hurricane is shown on the Chart commencing between Nos. i. and ii.

Martinique is said to have been 9,000. Dominica likewise suffered greatly, and Guadaloupe was within the northern verge of the hurricane.

At *St. Eustatius*, although not far within the N.E. verge, the loss was very great. On the 10th of October, at eleven a.m., the sky on a sudden blackened all round; it looked as dismal as night, attended with the most violent rains, thunder, lightning, and wind. In the afternoon the gale increased; seven ships were driven on shore near the North point, dashed to pieces on the rocks, and their crews perished. Nineteen vessels cut their cables and went to sea. In the night every house to the northward and southward was blown down, or washed away with the inhabitants into the sea, a few only escaping. The houses to the East and West were not so much hurt till the afternoon of the 11th, when the wind, on a sudden, shifted to the eastward; and at night it blew with redoubled fury, and swept away every house; but the forts, barracks, hospital, cathedral, and four churches, remained. Here between 4,000 and 5,000 persons are supposed to have lost their lives.

Advancing north-westward, the centre of the hurricane on the 14th had reached to the Mona Passage, on the West of Porto-Rico. Here the *Ulysses* and *Pomona*, with a fleet under their convoy, suffered greatly, and here the *Deal Castle* frigate was wrecked. Another frigate, the *Diamond*, fell within the western verge of the storm on the 15th, but happily escaped by passing Alto-Vela, on the South side of Hayti. Above the parallel of 20° the *Stirling Castle*, 64, was lost on the Silver Kay Bank, and most of her crew perished. On the 18th we find, in about 22½ N., and 69° W., the *Trident*, *Ruby*, *Bristol*, *Hector*, and *Grafton*, men-of-war, on the S.W. verge of the storm. The ship last mentioned, on the 16th, at noon, was in lat. 26½°, lon. (by estimation) 71° 30′; heavy gales and cloudy weather; lying-to under trysails; the gales split the sails to ribands. On the 18th, lying-to; strong gales and heavy squalls.—17th to 18th, carried rapidly to the south-eastward, when the *Trident*, *Ruby*, and *Hector*, came in sight as above. At eleven a.m. spoke the latter, in great distress.

The *Ruby*, *Trident*, and *Bristol*, on the 15th, were as high as 27½ N., and they, too, from the western border of the hurricane, were driven to the southward, until they joined company.

Here the detail becomes imperfect, until we reach the Bermudas; but to the N.E. of these isles we find the *Berwick*, 74, on the 19th, which had fallen, on the 17th, within the border of the hurricane from a position to the W.N.W., near the latitude of 35°. This ship had previously been one of Rear-Admiral Rowley's squadron; she was proceeding to England under jury-masts, and had reached to the North of the latitude of the Bermudas when the hurricane overtook her. On the 16th, at eleven a.m., during calm, there was a great swell from the eastward. On the 17th, at one p.m., she was taken aback; wore ship and handed topsails: at three, squally, with rain; loosed the topsails; six to eight, wind E. by N., fresh gales. On the 18th, winds variable from the eastward, E. by N. to E.S.E.; after midnight, strong gales and heavy squalls. At noon, by estimation, Bermudas S. 53° E. 31 leagues.—19th, at one a.m., weather moderate, and the ship proceeded on her course.

On the 18th about fifty vessels were driven on shore at Bermuda.

We have been the more particular in giving these details, from having formerly been misled by imperfect data. In the delineation of the "Great Hurricane," given by Colonel Reid, he first assumes a circle having a radius of about 170 miles, which gradually expands, on its N.W., North, and N.E. course, to 270, with, we may presume, a diminished and proportionate momentum, on the parallel of Bermuda. The colonel observes that, on reading the logs and the various accounts of this hurricane, and comparing the different reports of the wind, it will be found that no storm yet described, more strongly than this proves the rotatory nature of hurricanes; and, after attentive consideration of this tempest, in addition to the details of many others, it seems difficult to refuse belief to this being their mode of action.

Trinidad, *June*, 1831.—(*No. I. on the Chart.*)—It will not readily be forgotten that, on the 23rd of June, 1831, Trinidad, in the parallel of 10½° N., experienced one of the most awful storms of wind and rain ever remembered by the oldest inhabitant. The gale commenced at five o'clock on Thursday morning, and continued till eleven; the wind, after shifting from East, North, West, and South, finally settled at S.W., and blew without intermission until three in the afternoon. Eleven or twelve vessels were driven on shore, and several of them severely damaged.

It was subsequently stated that the hurricane was felt at all the southern islands, where

the loss it occasioned was very great. Such a storm had not happened at Granada since the year 1780; the devastation was extensive and dreadful; and the loss in that colony was estimated at £80,000. Its course to Yucatan is described hereafter.

Barbadoes, August, 1831.—(*No. II. on the Chart.*)—In the night following the 10th of August, one of the most devastating hurricanes that had ever been experienced visited Barbadoes. Not a single house was left uninjured, and the greater part were levelled with the ground. On the 11th it passed over the Islands of St. Vincent and St. Lucia, extending a portion of its influence to Martinique and islands to the N.W., and to Granada on the South, but exhibiting its principal violence between $12\frac{1}{4}^\circ$ and $14\frac{1}{2}^\circ$ N., or the parallels of Barbadoes and Martinique. On the 12th it arrived on the southern coast of Porto-Rico; from the 12th to the 13th it swept over the South side of Hayti, and extended its influence as far southward as Jamaica. On the 13th it raged on the eastern portion of Cuba, sweeping in its course over large districts. The town of Aux Cayes, in Hayti, was almost destroyed by its force, and that of S. Iago de Cuba was very much damaged. On the 14th it was at Havanna, and toward the West end of Cuba. On the 15th it proceeded north-westward, and on the 16th and 17th it arrived on the northern shores of the Mexican Sea, in about the 30th degree of latitude, raging simultaneously at Pensacola, Mobile, and New Orleans, where its effects were continued till the 18th. At New Orleans, on the 17th, it came on in dreadful gales, from N.E. to S.E., accompanied with torrents of rain. Almost all the shipping in the river were driven on shore, and very few of the smaller craft escaped total wreck. The back part of the city was completely inundated. The sugar-canes, above and below the city, were laid flat, and the loss was enormous. The gale was felt at Natchez, 300 miles up the river; and hereabout it spent itself in heavy rains, after having occupied a period of six days in its cycloidal course from Barbadoes.

At most of the islands, during the hurricane, the winds in the earlier part of the storm were from a northern quarter, and in its later periods from a southern quarter, of the horizon; from which it results, that the gyratory action was from *right* to *left*, as in the storms which pass to the northward of the great islands, and along the western coast of the ocean.

The distance passed over by the storm, in its passage from Barbadoes to New Orleans, is equal to 2,100 nautic miles. The average rate about 14 miles an hour.

The details of the storm in August, 1831, as it affected *Barbadoes*, *St. Vincent*, and *St. Lucia*, were given in the *Times* newspaper of the 10th of October, in the same year. In the despatch of his Excellency *Sir James Lyon*, governor of Barbadoes, it is noticed that, on the evening of the 10th, the sun set on a landscape of the greatest beauty and fertility, and rose on the following morning over an utter desolation and a waste. The prospect at daybreak on the 11th was that of January in Europe,—every tree, if not entirely rooted up, was deprived of its foliage, and of many of its branches; every house within view was levelled with the ground, or materially damaged; and every hour brought intelligence of the most lamentable accidents and of very many shocking deaths.

The evening of the 10th was not remarkable for any peculiarity of appearance; but in the night it began to rain, accompanied with flashes of lightning and high wind, which appeared to come from the North and East; toward midnight the wind increased, and was more to the westward and S.W.; the rain fell in torrents, and the lightning was vivid in the extreme; at one o'clock the hurricane had commenced, and from two until daybreak it is impossible to convey any idea of the violence of the storm; no language can sufficiently express its horrors. The noise of the wind, the peals of thunder, and the rapidly repeated flashes of lightning (more like sheets of fire), and the impenetrable darkness which succeeded them, the crash of walls, roofs, and beams, were all mixed in appalling confusion, and every house shook to its foundation.

The tempest did not entirely cease, nor the atmosphere clear up, until about nine o'clock in the morning of the 11th, when many families were found to be buried in the ruins; and the few ships in Carlisle Bay were driven high on the strand.

At an early hour on the morning of the 12th, the storm commenced from the northward on *St. Vincent*, but was not much felt at Kingstown and the shipping on the West until about half-past eight, when its violent effects were excessively destructive. Every vessel at the anchorage, with the exception of one, was cast on shore, and every plantation sustained damage, more or less, by the total destruction of crops and provisions, buildings, works, and negro-houses.

St. Lucia, it appears, did not suffer so much as St. Vincent; but even here the destruction was immense. In the night of Wednesday, the 10th, the same night on which the hurricane commenced at Barbadoes, the sky had a very heavy, lowering appearance; and early on the next morning, with the wind at North, it began to blow very fresh, which continued increasing, accompanied with rain, until five o'clock; and by seven, or half-past seven, the prognostics of a hurricane appeared; by a little after eight the harbour presented a most awful appearance, the sea ran mountains high, and broke on the South side with the utmost violence, and the vessels in the anchorage became ungovernable. In this condition the town was situated from half-past eight to twelve o'clock, when the wind, which had prevailed in frequent and violent gusts, became more moderate, and before two o'clock it was comparatively calm. During the continuance of the storm it rained unceasingly, but not violently, and the wind seemed to vary very little from its ordinary direction.

HURRICANE OF 1830.—The storm which passed the city of New York, on the *17th of August*, 1830, was there, and along all the coast northward of Cape Hatteras, considered as a *north-east storm*.—(*See Chart, Route VI.*)

It appears that this commenced at the Island of St. Thomas, in the West Indies, on the night between the 12th and 13th of August. On its progress, in the afternoon of the 14th, it commenced at the Bahama Islands, and continued during the succeeding night, the wind almost round the compass during the existence of the storm. On the 15th, in the Florida Channel, its effects were very disastrous. Without the strait, in lat. 26° 51′, lon. 79° 40′, the gale was severe from N.N.E. to S.W. Late on the same day, off St. Augustin, it was equally so. At 20 miles North of St. Mary's, from eight p.m. on the 15th, to two a.m. on the 16th, it was from an eastern quarter, then changed to S.W., and blew till eight a.m.

Off Tybee and at Savanna, on the night of the 15th, it changed to N.W. at nine a.m. on the 16th, and blew till twelve. On the 18th, at Charleston, the gale was from S.E. and East, till four p.m.; then N.E. and round to N.W. At Wilmington (N. Carol.) the storm was from the East, and veered subsequently to the West. In the vicinity of Cape Hatteras, at sea, the storm was very heavy from S.E., and shifted to N.W.

Early in the morning of the 17th, the gale was felt severely in the Chesapeake, from the N.E. Off the capes of Virginia, on the 17th, lat. 36° 20′, lon. 74° 2′, "a perfect hurricane," from South to S.S.E., from five a.m. to two p.m., then shifted to N.W.

Off Cape May, lat. 32°, lon. 74° 15′, in the afternoon, of the 17th, a heavy gale from E.N.E. Coast of New Jersey, same afternoon, heavy at N.E. Again, in lat. 39°, lon. 73°, at E.N.E. In the same latitude, lon. 70° 30′, a "tremendous gale," commencing at S.S.E., and veering to North.

Afternoon and evening of the 17th, at New York and in Long Island Sound, gale at N.N.E. and N.E. Off Nantucket Shoals, at eight p.m., severe at N.E. by E. In the night of the 17th, off Nantucket, and in the Gulf Stream, lat. 38° 15′, lon. 67° 30′, "tremendous," commencing at South, and veering, with increasing severity, to S.W., West, and N.W. Peninsula of Cape Cod, in the night between the 17th and 18th, severe at N.E.; 18th, at Salem and Newbury, heavy gale from N.E. In lat. 39° 51′, lon. 69°, severe from S.E., suddenly shifting to North. In lat. 41° 20′, lon. 66° 25′, "tremendous hurricane," from N.N.E.

Off Sable Island, in the night of the 18th, lat. 43°, lon. 59½°, "tremendous heavy gale," from South and S.W. to West and N.W. In lat. 43°, lon. 58°, a severe gale from the South; the manner of change not reported.

This remarkable storm appears to have passed over the whole route above described in about six days, at an average of about 16 miles an hour; the duration of its most violent portion, at the several points over which it passed, may be stated at from seven to twelve hours; and the width of its track is supposed to have been from 150 to 200 miles.

"On the western part of the Atlantic Ocean, between the parallel of New York and the northern limit of the trade-wind, the prevailing winds, for a considerable period, both previously and subsequently to the occurrence of this storm, were south-westerly, or from the southern quarter; and over the whole breadth of the Atlantic, on the route frequented by ships in the European trade, fresh south-western or westerly winds also prevailed at the same period, for many weeks. These facts are well established by numerous marine journals, which have been consulted in relation to this subject.

Of the vorticular or rotative character of the storm, striking evidence has been afforded by the journals of two ships, the *Britannia* and the *Illinois*, both bound from America to Europe; the particulars of which are fully given in the Exposition by Mr. Redfield.

In about a week after the storm last described, another occurred, which passed New York on the 26th and 27th of August, and which was, also, on this coast, a N.E. storm, of about three days' duration. From the eastward of the Bahamas it appears to have passed northwardly between the Florida Stream and the Bermudas; and touching the American shore near Cape Hatteras, raged with great fury for about forty hours at each locality, as it swept the great central curve of the coast; and passing from thence, continued its course over George's Bank, in a north-easterly direction. It was evidently of greater compass, and slower progress, than the preceding storm, as is proved by a collation of the various reports of mariners; and its long duration, and its effects were almost equally violent.

The next remarkable series of hurricanes appear to have originated in the vicinity of the Windward Islands, near the close of September, 1830, and which, passing westward of the Bermudas, on a course nearly North, assumed thence a more easterly course, toward the southern edge of the Grand Bank of Newfoundland.—(*See the Chart, Route VII.*)

This storm was very disastrous. In lat. 20½°, lon. 63°, it commenced, on September 22, at one p.m., and continued till half-past six p.m., from N.E. and S.W. alternately. On the same day it passed through lat. 22° 46′, lon. 65°. At night, on the 30th, in lat. 26° 7′, lon. 66¼°, "very heavy," for five hours and a half. On the 1st of October it arrived at lat. 30° 38′, lon. 63°; severe at S.E., shifted to N.W.: thence it was found in lat. 33°, lon. 66½°; lat. 34° 9′, lon. 66° 12′; lat. 35°, lon. 68°; lat. 38°, lon. 63°; lat. 38½°, lon. 57°; lat. 40°, lon. 61°; lat. 40° 25′, lon. 58° 24′; lat. 41°, lon. 55°, and very severe. By an average estimate of rates and distances, it appears to have proceeded at the rate of about 27 miles an hour.

The extensive hurricane of 1804, which swept over most of the Windward Islands in the West Indies, commenced at Martinique, on the 3rd of September, reached Savanna on the 7th, Boston on the 9th, and became a *snow-storm* on its arrival in the interior of New Hampshire.

The great gale of 1815 commenced at St. Bartholomew's on the 18th of September, and reached Rhode Island on the morning of the 23rd, where it was awfully destructive from the S.E., while in the south-eastern parts of Massachusets it was then blowing at South; at New London from East to S.E.; and at New York from North to N.N.W.*

A violent N.E. snow-storm, December 6, 1830, swept along the whole of the United States' coast in the same manner, it being experienced from the southward and westward by vessels which were at a certain distance from the coast.

A S.E. storm, in September, 1821—(*see Chart, Track VIII.*)—was experienced in the central parts of Connecticut, commenced blowing violently from E.S.E. and S.E., at about six p.m. on the 3rd of September, having been preceded by a fresh wind from the southern quarter, and flying clouds. It continued blowing in heavy gusts, and with increasing fury, till about ten p.m. when the wind suddenly subsided. A calm or *lull*, of perhaps fifteen minutes' duration, ensued, but was terminated by a violent gust from the N.W., which continued till about eleven p.m., and then gradually abated. Much damage was sustained, and fruit-trees, corn, &c., were uniformly prostrated toward the N.W.

At New York the same storm was experienced, with at least equal violence, about three hours earlier than in Connecticut, but blowing from a more eastern quarter. In the north-eastern parts of Massachusets it was experienced some hours later; and at Providence, in Rhode Island, the storm was felt in the south-eastern quarter, but not severely; as was, also, the case in the south-eastern parts of Connecticut. In the N.W. portions of the latter state, and the adjacent towns of Massachusets, the gale blew with its chief violence from the N.W. quarter, and the trees and corn were uniformly prostrated toward the S.E.

At New York the gale was from N.E. to East, and commenced blowing with violence at five p.m., continued with great fury for three hours, and then changed to West. More

* It appears that, previous to this, on the 9th of August, 1815, a furious hurricane occurred on the Gulf Stream, by which H.M.S. *Warrior*, Captain J. T. Rodd, in lat. 40° 29′, lon. 59° 58′, was driven out of the stream, and to the northward of it, as shown by Major Rennell in his *Investigation*, pp. 169, 202, 238.—Ed.

damage was sustained in two hours than was ever before witnessed in the city, the wind increasing during the afternoon, and *at sunset was a hurricane*. At the time of *low water* the wharfs were overflowed, the water having risen 13 feet in an hour. Previous to the setting in of the gale, the wind was from South to S.E., but changed to the N.E. at the commencement of the storm, and blew with great fury till evening, and then shifted to the westward.

The following HURRICANES, in addition to those already noticed, have been described by Colonel Reid, in his "Law of Storms."

1. *Barbadoes Hurricane*, over the N.E. part of Hayti, and thence over the Great Bahama Bank to the coast of Florida, 26th July to August 1st, 1837.

2. *Antigua Hurricane*, over Porto Rico, Turks' Islands, St. Salvador, Abaco, and Darien, including St. Augustine and Charlestown, August 4th, 5th, and 6th, 1837.

3. *Hurricane to the N.E. of the Caribbee Islands*, thence to the N.W. to the parallel of 30° N., and thence N.E. to latitude 40°, in longitude about 60° W., 12th to 22nd of August, 1837.

The Hurricane of the 26th of July (No. 1, above) passed over Barbadoes in the morning of that day: at ten in the night following it was at Martinique, and at this time it had ceased at Barbadoes. At midnight of the 26th it reached St. Croix; and, by the 30th, the Strait of Florida, where some vessels were wrecked by it, and many damaged. It then took a more northerly direction, and was, on the 1st of August, at Jacksonville, in Florida. From Jacksonville it passed over Savanna and Charleston, and thence in a direction eastward of North.

The Hurricane, No. 2, above, was at Antigua on the 2nd of August; by the 5th and 6th on the coasts of Florida and Georgia, where it crossed the line of the Barbadoes hurricane (No. 1), and it seems to have extended, on the 8th, to Pensacola. The American journals of 1837 stated that it had been experienced at Savanna and other towns in the vicinity. It appears that it commenced there at noon, and continued for a whole day with unabated fury. The destruction of the shipping was very great, and numerous building were blown down. At St. Mary's the effects were also felt severely. The devastation extended to the River St. Juan, where the crops were entirely destroyed.

A letter from *Darien*, dated August 10, stated that, during the past week, they had there been visited by a storm, which had not been equalled since the one of the year 1824. The wind on Sunday, August 6th, in the morning, blew fresh from the N.E.; in the after part of the day it had shifted round to S.E., when rain began to fall in heavy torrents. The wind then rose very high, and began to blow with fearful violence, tearing up the oldest oak and mulberry trees by the roots, while limbs and branches of the different trees were flying in all directions. The water of the river then rose, and covered the rice plantations so completely, that they appeared to the eye to form part of the river. Accounts from the country represented the cotton crops to be all but destroyed, the corn broken down, and many houses unroofed.

At Jacksonville, on the River St. Juan, to the southward, it was stated that they had the hurricane for two days. Houses innumerable destroyed, two great stores demolished, and crops completely laid waste in the fields. Of vessels which materially suffered hereabout, the *Bolivar* drifted 9 miles over the marsh, and was left about 600 yards from the bed of the river; the *Virginia*, in the same state. The *Forester*, after having dragged 6 miles over the marsh, left high and dry 400 yards from the river. *George and Mary*, from Charlestown, lost, crew saved. The *Favourite* drifted over the bar, and afterward sank in Jacksonville Harbour. The *Anne*, after drifting 6 miles into the woods, was left 700 yards from the river. A schooner on shore on Cumberland Bank, and a sloop near Fernandina, with mast, &c., broken.

On the 6th, the St. Augustin packet schooner, two days from St. Augustin, and bound to Charlestown, upset off Jekyl Island, and only only one person, a seaman, escaped.

The Hurricane, No. 3, a most disastrous one, was met with by three ships to the N.E. of Antigua, on the 15th of August, 1837, as shown by Colonel Reid, in his Chart VII., and it has been traced thence W.N.W. to lat. 25°, and thence again to 30° N., in lon. 77°. On the 18th, the ship *Rawlins* appears to have been becalmed, near the centre of it, and of a circuit supposed to be 600 miles in diameter. On the 21st of August, we find the ship *Westbrook* near the centre, in lat. 35°, lon. 73°; and on the next day the *West Indian*. lat. 39°, lon. 61½°. From the parallel of Cape Hatteras, the course of the hurri-

cane appears to have been along the eastern and southern sides of the Gulf Stream. Colonel Reid has given very copious and interesting extracts from the journals of ships which suffered by it, as shown in the "Law of Storms," pp. 68 to 117.

In the month of August, 1827, the American coasts and nearly all the West Indies were visited by violent hurricanes. In the West Indies they were said to be most dreadful. On the 18th, 19th, and 20th of August, they caused great ravages at Antigua, St. Christopher's, Barbadoes, Hayti, Jamaica, &c. At the city of St. Domingo they commenced on Saturday, August 18th, from the S.E., and terminated with the wind from S.S.W. All the mahogany on the coast was carried to sea, and most of the vessels in the harbour were driven on shore. Those at anchor in the mouth of the harbour got under way at the commencement of the gale, put to sea, and were all wrecked.

The tail of the hurricane was over Port-au-Prince from three p.m. till about three a.m. (18th and 19th). It came from the N.E., threw the shipping into some confusion, but did them no serious damage, though the plains and ridge of mountains were almost laid waste.

These hurricanes caught the ship *Salacia*, on the 24th of August, without the Florida Stream, in lat. 32° 30′, lon. 73° 48′, when she drifted W.N.W. to lat. 32° 50′, lon. 74° 40′. A second hurricane attacked her on the 7th of September. It blew furiously on the 8th and 9th, when the deck was swept by the sea, and several persons washed overboard. On the 10th she was totally dismasted, and on the 11th experienced another heavy gale.

In the hurricanes of the early part of the following year, 1828, H.M. sloop the *Acorn*, of 18 guns, with the *Contest*, gun-brig, of 12, and the *Sappho*, of 18, were lost, with every soul on board, between the Bermudas and Halifax. The *Tyne*, 28, in company, weathered the storm.

H.M. brig *Beaver*, Captain T. Edwards, arrived at Falmouth from Jamaica and Crooked Islands, on the 16th of January, 1828. For the last three weeks the *Beaver* had experienced very severe gales from the westward; and so heavy was the sea, that, on two occasions, she was nearly going down, and was obliged to throw her guns overboard; the boats were washed from the quarters, and her upper works stove in.

This weather reached Plymouth Sound on Sunday, January the 13th; for, shortly after midnight, a violent hurricane came on from the S.W., accompanied with vivid flashes of lightning, much rain and thunder. The greatest alarm and confusion prevailed, as the harbour and sound were crowded with shipping. When day broke, there were, altogether, thirteen vessels on shore; six in Deadman's Bay, six in Mount Batten Bay, and one in Bovisand Bay. Eight ships, however, rode it out in the sound without damage. On shore, the destruction of chimneys and roofs of houses was very extensive; and altogether, says the describer, this hurricane is a visitation that will long be remembered.

The hurricane, however, did not extend in its violence and ravages, in any considerable degree, to the neighbourhood of Portsmouth; but a striking proof of the effect of the storm was exhibited in the return of the free-trader *General Palmer*, Captain Truscott (R.N.), which ship had left St. Helen's on Saturday morning, on her passage to Madras and Bengal, which she had done several times before, performing the voyage in remarkably short periods of time. The wind was from the southward and eastward; she made a good offing; but, after night-fall, the wind constantly headed her and freshened, which circumstances kept Captain Truscott and the whole crew on deck during the night, shortening sail and making the ship snug, and everything secure. At six a.m. on Sunday, when about 15 miles off Portland, the ship was wore, laid with her head off the land, and scarcely brought to the wind on the starboard tack, when a sudden gust or squall carried away her three masts at the same instant, about 2 feet above the deck. The ship, from the heavy sea running, shipped a quantity of water and laboured much, but, from the previous precautionary means which had been taken, this did not injure the hull; the wreck was cleared as soon as possible, and upon a boat's mast a small sail was hoisted, by which she was got before the wind; fortunately, she made Dunnose in the afternoon, and anchored at St. Helen's about sunset.

HURRICANE *at Antigua*, in 1835.—To the description of previous hurricanes we now add one of the hurricane at Antigua, in August, 1835, from the pen of our respected friend *Lieutenant Bisschop Greevelink*, of the Dutch Royal Navy.

"During our stay in English Harbour, we were visited by one of those unwelcome guests which always leave deplorable marks of destruction behind them; and as I am of opinion that their prognostics and operations cannot be too frequently described, I here give the following particulars of those which I had an opportunity of observing at Antigua.

"On the morning of that day in which this hurricane happened, the sun rose as beautifully as ever; a clear expanse and a gentle breeze gave reason for expecting fine weather. At about eleven the heat became rather oppressive, the last breath of wind died away, and the trees hung their branches and dropped their parched leaves. At twelve, when just returning from a walk in the country, there appeared in the East a huge mass of clouds, of immense extent from North to South, emerging from behind the hills which surround English Harbour. Slowly they moved onward, spreading darkness beneath their black columns, while the silence of the grave reigned below; the water became agitated, and 'deep sounds and deeper still' began to 'howl from the mountain's bosom,' but yet there was not a breath of wind to be felt.

"In about ten minutes, the border of the cloudy vault had reached its zenith, when it discharged a shower of rain, and, involving us in the shade, continued its course to the West: every living object now seemed well aware of what was pending; the birds hovered round in anxious speed, and they all hastened to their place of shelter.

"This occultation lasted for a most solemn half-hour, till it had reached the western horizon, when suddenly the hurly-burly began. Wind from the northward, with a brisk gale, gradually increasing; the breaking of the waves against the coast, and in the mouth of the harbour, redoubled its fury, and seemed to work by certain hidden powers from beneath, as the foam was thrown up to a height of more than 100 yards, without the surface of the water being pressed on by the wind.

"At three p.m. it blew a complete storm; the clouds, which wore a dismal gray appearance, and flew in the same direction as the wind, rolling and tumbling over each other in rapid motion, produced only weak glances of lightning; but not a single flash or thunderstroke was observed during the whole event. An hour afterward the wind veered to the N.W., still increasing in force, while the whole atmosphere became thickened as with vapour, and twilight dimmed every remote object. Between five and six the wind shifted again to the West and southerly, at first wavering and as if reluctant, but, soon fixed in that quarter, it blew with redoubled force, pouring forth torrents of rain: at the same time the progress of fleeting aerial volumes was obstructed in the S.E., where they gathered into one thick body, emitting continual glarings of lightning, and just enabling us, from time to time, to get a faint view of ghastly figures flying onward with most amazing speed, until they had formed a compact mass of electric matter, sufficient to counteract the force of the south-westerly wind, and to destroy, perhaps, many a mortal hope.

"At about seven, these collected clouds loosened from the South, and half an hour afterward from the S.E., raging with almost irresistible violence, which I shall not attempt to describe; I will merely add, that the heavens and the earth were now literally mingling; two of our heavy ground tackle and a chain broke at once, and the ship grounded in 9 feet of water, most happily on a bottom of soft mud. At half-past eight, the wind had reached its highest degree of strength, which it retained for only half an hour, soon after diminishing; so that at eleven o'clock nothing more than a common trade-wind was felt. The moon, then full, showed again her broad face, as if in mockery, and the clouds, now separated, drove off in squalls of thunder and lightning.

"From this hurricane we may make the following conclusions:—In the first place, that it arose during one of the principal phases of the moon, as also that it came from the eastward: and by accounts from other islands we observe its course to have been to the W.N.W., and very narrowly limited in its breadth; as, at the time of its devastating the plains of Antigua, not the least trace of its existence was observed in the islands of Guadaloupe, Montserrat, or Barbuda; and again, on its raging over St. Kitt's, nothing was felt at St. Martin's: thus these storms may be avoided, by running to the southward or northward, which was, in fact, attempted and affected by the British steam-packet *Spitfire*. The manner in which the wind changed its direction is also worth noticing, as it teaches mariners (should they ever go round the same way), when unable to gain the limits of its extent, and thus be compelled to withstand its fury, to put the ship's head off the wind, upon the starboard side, so as to prevent the wind's shifting from under the lee-bow while lying-to."

The *American Journal of Science and Arts*, vol. xxxv., contains a paper, entitled, "On the Courses of Hurricanes; with Notices of the Tyfoons of the China Sea and other Storms; by W. C. Redfield, Memb. of Conn. Acad. of Arts and Sciences, Corr. Memb. of U.S. Naval Lyceum, the Albany Institute," &c. In this disquisition the principle previously admitted is more fully confirmed, and the striking uniformity of the preceding results verified: and here it is observed that the inductions have been usually on the theory of an *exact circle* in the course of the winds, which, in large storms and for practical purposes, is, in most cases, sufficiently accurate. But it sometimes happens that the higher portions of the storm overrun the inferior portions, and reach the surface in advance of the main storm; thus presenting the wind, for a few hours, in a direction not accordant with that exhibited by the main body of the storm. It may also be added that, in the most violent of these storms, it is at least probable, if not certain, that the course of the surface wind is spirally inward, approximating gradually to the centre of the storm.

"At stations within the tropics, the changes of wind, during the passage of the hurricane, are sometimes known to *exceed* those which pertain to the passage of a regular circuit of wind; these changes sometimes running through the entire circuit of the compass and even more. Again, they have been known to shift *backward and forward*, in alternate and fitful changes, when near the crisis of the storm. These phenomena, so far from disproving the rotative character of these gales, only prove something more, and afford, at least, probable evidence in support of one or both of the following positions, viz.—1. That high land and other obstructions often produce sudden and fitful gusts and changes in these violent winds. 2. That, in accordance with our observations of minor vortices, the axis of rotation is often impelled, excentrically, around a smaller circuit, in the interior of the advancing storm.

"In the northern intertropical latitudes the recession or departure of the south-eastern limb of the storm appears to be followed, not unfrequently, by strong squalls or gusts from S. E., this being the true course of the general trade-wind that determines the track of the storm. These gusts or squalls, if mistaken for the regular action of the hurricane, may occasion erroneous deductions in regard to the course of the storm.

At stations apparently within the regular track of the storm, there will sometimes be an absence of violent wind; or the violence will pertain to only one of the phases, which the storm presents, in its regular course over such locality.

"Some storms are interrupted in their development by the near approach of another storm. Care must be taken therefore not to mistake the N.E. wind of a storm whose north-western limb is thus intercepted by a bordering storm, and which hence is sometimes followed by the natural current of air from the S.W. quarter, for the changes that pertain to the centre of the gale."

Mr. Redfield says, in conclusion, "That courses and developments of the storms which pass over the Island of Great Britain are believed to be more complex than on the shores of the United States. It is not improbable that the course of many European storms is in a south-eastern direction. A comparison of marine reports has shown me that, while a storm was blowing at West or W.S.W. in the English Channel, it was blowing S.E. at Elsinore; at N.E. on the East coast of Scotland; and at North and N.W. in the Irish Channel; thus exhibiting, plainly, a rotation to the left: but it is on careful investigations, hereafter to be made, that we must rely for a proper development of the system of European storms."

The memorable hurricane of the British Islands, which occurred on the 28th of October, 1838, has been described from various reports dated from Plymouth, Dublin Bay, Orkney Islands, Bristol, Aberavon, Hull, Harwich, and Dover, as shown in the *Nautical Magazine* of February, 1839. Its progress, says the editor, affords a good practical illustration of the "Redfield Theory," as it was similar in most respects to those of the West Indies, excepting in excessive violence.

It follows, therefore, that, from simply knowing that the wind gyrates around a centre, as above mentioned, we deduce the important fact, that, by placing a ship in a certain position, according to the direction of the *first* shift of wind experienced in a hurricane, she will be enabled to avoid, with a prospect of success, the centre of rotation, where the greatest danger is to be apprehended.

In the intertropical seas, the most general path pursued by hurricanes is to the N.W., curving to the North in about the 30th degree of latitude, when their course becomes

north-easterly (in the direction of the Gulf Stream), and, as they sweep along the higher latitudes, the direction of their progression becomes more easterly still. Some have, however, pursued a more westerly course.

The diameter (and consequently the circumference) of hurricanes varies, and it appears that a dilatation generally takes place as the storm progresses. It is probable that, as the circle becomes more and more enlarged, the power of the wind gradually lessens, until the energy of the action is entirely lost. Some hurricanes, whilst raging with great violence, are of immense extent, while others appear to be merely local disruptions. Of the latter was that which passed over Antigua, in August, 1835, as hereafter described.

The main object of the navigator, when assailed by a hurricane, should be to keep his vessel *clear of the centre of rotation*, as there the strength of the wind concentrates, sudden shifts take place, and heavy and confused seas break. It is obvious, that the nearer the vortex is approached, the quicker the shifts of wind will be, and *vice versâ*.

The *centre of the storm* is most likely to be different at various times; but it is certain that, in some cases, a calm interval occurs, and this of considerable extent; while in others it has been thought that there is no calm or open space free from its impetuosity. At all events it must naturally be supposed that the nearer the proximity of the centre, the greater must be the danger from the force of the wind, and its more quickly shifting its direction.

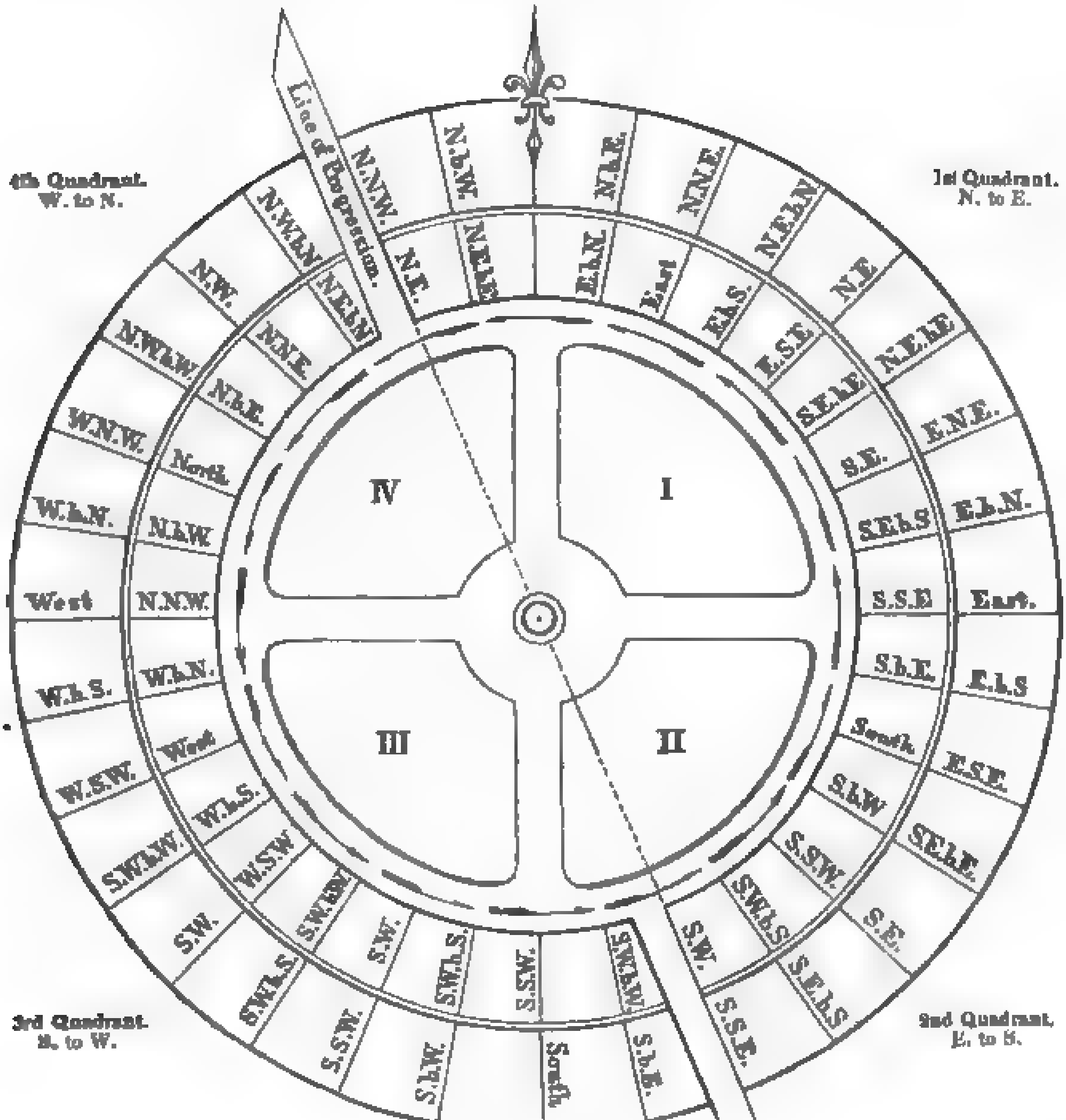
Lieutenant Evans remarks that, "When fairly under the dominion or power of the storm, and in any part of the area, except in the immediate vicinage of the centre of rotation, a ship will not be liable to be taken aback; because, if scudding, she would not intersect the wind; and if she be lying-to, it will either break her off, or draw aft gradually, according to the tack she is on: but the case may be different under certain circumstances. Most ships are dismasted at the *crisis;* that is to say, at the time the wind *blows strongest*, which is always on the nearest approach from the centre to any given position. The point at which the wind of the hurricane *commences*, if observed, will make known to the observer the verge under which he is placed.

"Although," adds Lieutenant Evans, "it is true that the prognostics of a coming storm are, in general, sufficiently plain to be understood by a spectator, from the angry appearance of the firmament, yet it is also true that there is no particular indication in any one quarter of the horizon sufficiently marked, like the space occupied by the *Black squall* panoply of the Caribbean Sea;—so that an acute seaman shall say—'thence will the blast come.' On the contrary, the clouds gather together (we speak from experience) in dense masses, of a cinereous hue, in every direction, until the whole canopy of heaven is overspread, and the gloom at last becomes so intense, that, even at mid-day, to speak within bounds, beyond a quarter of a mile no object can be even indistinctly seen. There are, however, some degrees of variation in the intensity of the obscurity; but we all know that the measure of distance by the eye upon such an exciting occasion is not likely to be very exact; at one period in a hurricane, just as the ship was dismasted, at the *crisis*, near noon, we could not clearly distinguish the end of the bowsprit from the quarter-deck.

"Every seaman knows the value of the marine barometer; on every occasion we should watch it closely, whether within or without the tropics."

From the description given by the officers of the several ships which have been in hurricanes at different periods and in different parts of the West Indies, it appears that they have seldom happened without sufficient warning of their approach having been afforded; such as light variable winds; density of the atmosphere; the clouds low and heavy, rolling over each other with quick motion. It has been observed, that, with every appearance of bad weather, if there be much thunder and lightning, a hurricane is not to be expected or apprehended; but they have occurred where lightning *without* thunder has happened. With these prognostics, ships should always be thoroughly prepared to receive a most violent gale: the ships should be made as snug as possible; all the heavy materials carried below, as shot, &c., &c.; the pump-gear examined, and the topmasts got down and secured; for in every instance of hurricane, the ships have lost their topmasts in half an hour, and the clearing the wreck has interfered with other very essential duties. In H.M. ship *Theseus*, of 74 guns, during a hurricane, the shot-lockers gave way, broke into the well, and carried away the pumps: the ship had then 6 feet of water in the hold, with the only alternative of baling to save her.

The hurricanes of the West Indies having been seldom known to extend to the southward of 12° North latitude, the indications above mentioned being given, it may be very desirable, if practicable, to endeavour to reach that degree of latitude, at least, before they come on. In every place where ships may happen to be at anchor, during this season, the pilots will naturally give timely notice, from their own local observations, of the approach of bad weather; but it is generally suspected by the rising of the water in the harbours, and the heavy hollow surge of the sea upon the contiguous beaches and bays. The season in which hurricanes are expected is from August to the full moon of October; and it is said that they most frequently happen three days before, and three days after, the full and change of the moon, during that period.



In order to simplify this subject, and render it perfectly clear, a copy of the figure annexed (obligingly communicated to Mr. Purdy by Lieutenant Evans, in March, 1837) may be drawn on thick paper or card-board, upon an *enlarged scale*. The outer circle to be *fixed*, representing the points of the horizon; the inner circle, with index, to be moveable, and attached, with a button in the centre, so as to revolve on the outer or under

circle: thus the inner circle may represent the *phases of the wind*, as it gyrates round a centre; the arrows showing the revolution of the aerial current from right to left. The moveable circle is subdivided into four quadrants, for the purpose of facilitating the mode of operation.

Here, says Lieutenant Evans, it will be obvious that, if a vessel be caught under the N.N.W. verge of the hurricane, the wind, as shown by the arrow annexed to that point, will be, apparently, from E.N.E., and the changes will be seen as they occur progressively. On the N.E. verge of the hurricane the wind will appear to come from the S.E. On the North verge the wind will be East; and if on the West, it will be northerly, as shown in the figure.

The subject, when considered, will be readily understood: only bearing in mind that the shifts of wind will appear, *in most cases*, to be from left to right, *while the general wind is actually qursuing quite a contrary direction.*

To use the instrument, formed as above, place the moveable circle upon the under one, East, in juxtaposition with the North point of the horizon. The vessel's position may be marked as a stationary spot on the outer or under circle—say under the N.N.W. verge, where the wind is at E.N.E.; then move the upper circle in the line of progression to the N.W., which is the general line pursued, and the changes of the wind will be seen as they occur on the object marked.

The direction of the wind is independent of the progression of the storm; and as the current of air, whilst sweeping round the centre, pursues one unvaried path, it follows that, under every point of the horizon, there will be experienced a wind blowing at right angles to it, unchangeable in its direction; thus, under the *North* point of the horizon, there will be an East wind; under the *South* point, a West wind; and under the *East* point, a South wind. So that, were the storm stationary, a ship scudding round the entire circle, from any given position, would experience the wind from every point of the compass, in regular succession; but this, as the fact is, can very rarely, if ever, happen, on account of the progressive movement of the entire meteor.

As these storms do not pursue a uniform velocity, the rate of their actual progression can be arrived at only after they have ceased to act on any two or more stationary spots; or upon two ships, by noting the exact time each experienced the first shock of the hurricane, and also the time of its departure, respectively. Some cause or causes operate to accelerate the rate at one time, and retard it at another.

On reference to the preceding diagram, it will be seen, that if a ship first encounters a hurricane with the wind at E.N.E., she will be under the N.N.W. verge; and as the progression is (generally) to the N.W., the changes of wind will be to the eastward, going round to the S.E. and South, and ending with it at about S.W. by S. *Apparently* these changes will be from right to left.

It becomes necessary here to observe that, although the general medium course of the hurricane in the West Indies has been found to be N.W., yet in two or three instances we have reason for believing that either a deviation in particular parts of its course, or otherwise a vibration of oscillation of the entire meteor, has taken place. Any deviation, however, from the general course pursued by the storm to the N.W. can easily be detected, from the veering of the wind; as that ought to be regular, when the progressive path of the storm is regular, except at or near to the vortex. For instance, if the hurricane commences at E.N.E., and the wind does not follow the regular successive changes, as noted above, we may be assured that the storm is not pursuing a course to the N.W.; and the true line of progression may be ascertained by the circle, so as to gain the corresponding points of change to those which occur.

Again, if the storm commences at North, the wind ought to veer (under the same progressive direction of N.W.) to the N.W., West, and end with it about W. by S. or W.S.W. But if, after the wind has got to West, the storm should end with it at South (as it did at Antigua in 1804), we shall be assured that a deviation had taken place to the westward in the progression, or otherwise a vibration or oscillation to the southward.

The uncertainty of these aberrations should not deter the navigator from placing confidence in the general remarks here given, as these (based on Mr. Redfield's theory) have been arrived at from experience, from facts which are incontrovertible, and from a careful study of the subject; and besides, should these variations not happen, and to a certainty they do not always occur (at least on the ocean), he may benefit by them; whilst, under a case of their occurrence, no rules can possibly be given for his guidance; he

must place his vessel in the best position his judgment points out, and passively await the result.

We shall now endeavour to explain, in the plainest manner we can, the operation of the wind, and its effects on a vessel in each of the quadrants, when the progression is to the N.W.

First, or N.E. Quadrant.—Wind from South to East. The changes of wind, if a vessel be lying-to, will *appear* to take place from *left* to *right* throughout: as the wind will *seem* to draw round from the eastward toward the South, although it is in fact proceeding the contrary way, or from right to left.

The navigator's attention is particularly directed to this apparent paradox; for, whilst he notes the wind down in his journal as veering with the sun, it is all the time, as remarked before, going the contrary way! The delusion is occasioned by the progression of the hurricane to the N.W., which, by receding from the vessel's position, has the effect of bringing up the more southerly *phases* of the wind in succession, and, consequently, imparting to these, an *apparent* contrary direction to that which the whole current of air is actually pursuing. This deceptory process is somewhat similar to the well-known astronomical illusion every day before our eyes: we allude to the apparent course of the great luminary. Not only can we imagine, from the evidence of our sense of seeing (not at all times to be depended upon), that the sun is moving from East to West, but, in common *parlance*, such idea is invariably expressed; yet everybody knows that this is only apparent, and that the delusion is occasioned by the diurnal rotation of the earth round its axis from West to East.

This point, however, once clearly understood, will no longer perplex us; and the best mode to adopt, in order to avoid being puzzled, is, to use the moveable circle with the *phases* of the wind marked on the rim, placing it over the fixed circle with the points of the horizon marked to represent the ocean.

We now proceed with the first quadrant. If a ship scuds to the northward, the direction of the alterations of the wind will in a great measure depend upon her velocity, as she is crossing obliquely the course of the progression: if she keeps pace with the *northerly* advance of the storm, the wind will remain the same; if she exceeds it, the wind will draw round to the eastward; and if the progression outstrips her, the changes will be to the southward. In either of the latter cases, the variations will be few, in all probability; and the westerly progress may be expected to cause the ship to be speedily thrown out of the circle of operations.

A ship is likely to enter this quadrant only under the northern verge from the North to the N.E. point: if she happens to be standing to the southward, within the limits of the trade-wind, she will be liable to be taken aback; but if standing to the northward, of course she will not.

Second, or S.E. Quadrant.—Wind from West to South. A ship lying-to, with the wind from any point between South and S.W., the shifts will be from the southward toward the West, *apparently* from left to right. If the wind be between the S.W. and West, there will be few if any changes, as the ship will be near the posterior line of the progression; what changes may happen will probably be from West towards the South. The vessel will soon be clear of the commotion. It seems pretty evident that a vessel will not, in the first instance, be liable to fall under the S.E. verge in this quadrant, for this reason—that she cannot overtake the hurricane, as its velocity, in all probability, at any time would exceed her rate of sailing. She may, however, just touch literally about the southern verge, where she would get the wind from the West. To enter this quadrant, therefore, a ship must pass through some other.

Third, or S.W. Quadrant.—Wind from North to West. A ship lying-to, the wind from the northward (as the storm progresses) will draw round to the westward, from right to left, truly as apparently so.

As a ship scuds to the southward and eastward, the wind will draw round in the same manner as mentioned above. It appears obvious, that a vessel falling into the storm, under any point in this quadrant, would merely feel the "*brush*," but she will be liable to be taken aback if standing to the northward or north-eastward, on first entering the scene of operation, supposing her to be within the limits of the trade-wind.

Fourth, or N.W. Quadrant.—Wind from East to North. If a ship lies-to with the wind at any point between East and N.E., it will *appear* to draw round from left to right,

or from N.E. by E. to East. If she lies-to with the wind between N.E. and North, the shifts will be from right to left, or from N.E. by N. to North. Under the N.W. verge (where the wind is at N.E.), a ship, being there in the line of the anterior progression, will drift, probably, into or very near to the centre of the circle, which, on account of the sudden shifting of the wind there, should, if possible, be avoided, as there the greatest danger may correctly be considered as existing.

If a ship scuds, under the same circumstances of winds, the changes will appear the same as above given; but slower in the first instance, and quicker in the second, for these reasons: that in the one case, the points of change are receding from her as she advances; and in the other, they draw toward her approach, her velocity through the water accelerating the alterations; and this difference is occasioned by the progression to the N.W.

Within the limits of the trade-wind, if a ship be standing to the southward, she will not be liable to be taken aback, or striking the storm in this quadrant, but she would be so if steering to the northward.

It should be constantly held in remembrance, that, under all circumstances, the wind remains the same; or, in other words, that under any given point of the horizon, the wind will be found to blow from a particular direction unchangeable, so that there is actually no shifting; the changes observable being occasioned by the progression of the storm to the N.W., and the movements of a vessel.

From this peculiar character of the tempest, the course which a ship will pursue through the circle of operations, as also the successive changes of the wind, as these appear to take place, become an easy problem to solve, after having noted the point from which the first wind or the first shift, is felt, *provided* no divergency in the course, or vibratory motion of the meteor, take place.

Although a ship in most cases, we imagine, may be more likely to fall into the circle of operations under the north-western verge of the storm than in any other part, as that is the anterior advancing section, no general rules can be laid down for the guidance of the mariner for placing his ship in such a position so as to ensure her not being taken aback when the storm shall be first felt, because until that moment arrives, when the direction of the first blast is to become his "polar star," he cannot, with unerring certainty, anticipate his position with respect to the particular verge of the hurricane that is approaching him.

Under such unavoidable circumstances, he must use his best judgment in preparations for meeting the worst, and be ready to lay his vessel to, or to scud, according to the direction of the wind first experienced. To be quite sure of what he is about to do, perhaps the safest plan would be to wait until the first *shift* takes place after the commencement of the storm; by which measure, his position would be confirmed, a point of material consequence to arrive at.

Every experienced seaman, after having given the theory his best attention, and made himself familiar with the whole working of the wonderful meteor, will of course follow the dictates of his own mature judgment, upon an occasion that will assuredly call forth the full exercise of it. Without, therefore, presuming or desiring to obtrude upon him the manner we ourselves should act under a case of such uncertainty, which would demand all the resources of mind of the individual commander, for the first time placed in such a dilemma, we shall nevertheless offer it here as a mere illustration.

Let us, then, suppose that we are steering to the northward in our ship, within the limits of the trade-wind (call it E.N.E.), and that certain prognostics appear, which our judgment informs us forbode a storm. If it happens to be the hurricane season, we are bound by prudence to prepare the ship for encountering a tempest of that nature, even though appearances may induce us to think that such would not eventually happen; for, whether a mere common gale or a hurricane should follow, every sensible person will admit that, during that season, it is the wisest, as it is the safest plan, to be prepared to meet the worst that may happen under such appearances. It must be recollected, that nature herself proclaims the warning, and her admonitions are not to be disregarded with impunity.

Without loss of time, we make the ship snug, hatches battened down, &c. This done, we should bring her to the wind on the starboard tack, with her head to the northward, with a fore and a mizen storm stay-sail. We cannot, as we said before, anticipate under

what verge of the storm we shall enter, but we shall have done all that prudence can dictate, by lying-to *without square sails*, and of course making our minds up to have the fore-and-afters blown to shreds by the new wind, come from whatsoever quarter it may. In this position we must wait patiently until the first shift of wind takes place. If this should be from E.N.E. to E. by N. and East, we should make ourselves easy in the position obtained, with reference to the particular verge of the storm, as well as in that we had placed the ship; having the assurance (from the shift of wind) that the anterior verge which had struck us, would be now running away at the rate of from 15 to 20 miles an hour, whilst our drift to the westward would not exceed 3¼ miles in the same time; so that every point that the wind drew round toward the South, would tell as plainly as if a map of the whole operations were suspended in the heavens overhead, for our consolation, that our exit from the commotion was rapidly drawing nearer and nearer; and that, if the ship proved equal to contend with the *crisis*, and no vibration occurred, we should escape the centre.

This may sound, in the style of the celebrated Francis Moore, of predicting memory, very like "taking a peep into futurity." We are not, however, studying the doctrine of probabilities. As far as we at present know of the matter, and (thanks to Mr. Redfield) we have gained a pretty general insight into it, there appears but two circumstances at all likely to upset our calculations and foresight of what is to happen, and these are, as intimated before, a divergency in the line of progression, or a vibration of the entire meteor; and here we are taught, that, with all the wide and searching capacity of our minds, there is a point beyond which it is not permitted man to peer. We have been allowed, however, to glean enough of the economy of this wonderful phenomenon, to excite our unfeigned gratitude to Him "who rules the whirlwind and the storm." We proceed:—

On the other hand, if the shift of wind was to the N.E., or even a point on either side, we should immediately know that we were in the "very jaws of the lion;" and to escape being overwhelmed in the vortex we must run for it.* On this occasion, every moment is of importance, when we bear in mind that we are now in the path which the centre will follow. To the S.W., therefore, we start away, not without an impressive dread, as the wind comes veering round and round toward the North, of a too close approximation to the vortex, toward which curve the ship makes inclines. If we could tell the exact diameter of the hurricane, and its precise rate of progression, we could calculate pretty accurately whether, and at what distance, we should pass the centre; but as these data can never be obtained, we have nothing, otherwise than *prudence*, to guide us in this particular case, the most perilous that can occur.

There is a very nice point to be determined upon at this juncture, and one, although there will be but a few minutes for decision, that should not be rashly settled; a sort of choice between the scalping-knife and the tomahawk—a very forlorn hope, take which measure you please; it is this: to scud under square sail, or to run with bare poles? Now, however desirable it is that top-sail should be carried in a storm where the waves rise to a great height, and break in heavy surf, and a ship's way is lessened as she drops into the trough, to prevent her from being pooped, yet, we say, although it should be practicable to set a close-reefed main-topsail, the propriety of so doing is questionable until the wind has drawn round to the westward of North (and then it might as well be left alone), for not before that will the dreaded centre have been passed; and as there can be no certainty of a ship's safety until that "consummation" has been accomplished, the chance of being taken aback with square sail deserves the most serious consideration of the commander. The danger in both cases is imminent; but, in determining for ourselves, we should run with bare poles, until finally thrown out of the storm. Indeed, after all the judgment, care, anxiety, and apprehension which may be displayed and felt on so trying an occasion, our approximation, notwithstanding the vessel's *dash* of 12 or 13 knots, may be so near the vortex as that every stick shall be blown out of her. And we impressively declare our conviction, that hitherto the majority, if not all, the vessels that have been lost in hurricanes and typhoons, have foundered by falling into the centre with square sail set whilst scudding. On lying-to, no sail would stand the disruptive puffs for five seconds!

* When the line of progression is to the W.N.W. (a direction which some of the more southern storms have pursued), it would be wrong to scud with the wind at N.E.; but when at N.N.E., it would be proper to do so.

We have ourselves, in utter ignorance of the operations as they occur, and are here stated, been scudding in a frigate, partly dismasted, with reefed *main-sail* (the only sail available), before the furious blast of a hurricane, after the wind had veered to the S.W. As it happened, we had fortunately dropped into the second quadrant, and were drawing near our exit, but we knew nothing of that; and if it had happened in the fourth quadrant, and we had got into the centre, there is no doubt but that the ship must have foundered! But to proceed:—

No other resource is available to us under such circumstances as described above; and no other alternative remains except the desperate one of heaving-to, defying the fury of the storm, and taking the chance of being thrown directly into the centre of commotion; where, if the ship should not founder, she would, there is scarcely a doubt, lose her masts, and be otherwise completely assailed at all points by the raging elements!

The N.W. verge of the hurricane, whilst it advances in that direction, is the "very head and front" of the danger, the nucleus of which follows, in a direct line, the advance of that point. The consequences, be they the foundering of the ship, or the loss of her masts, &c., are inevitable, if prompt and active measures are not taken to get out of that position.

Should the wind, at first, keep steady at E.N.E. for some time, which it would do (if the storm is of great extent) when a ship enters under the N.N.W. verge, the navigator may be a little puzzled how to act, as anticipating a shift, to determine his position; he need be under no apprehension; the shift will come in due time (according to the extent of the circumference) from the E. by N., and so gradually round (but quickening as he approaches the centre) to the southward: he may, however, expect to lose some of his spars when the *crisis* arrives.

We have dwelt longer upon the action of the wind in the fourth or N.W. quadrant, because under this anterior verge the greatest peril may follow; and we may now be permitted to express a hope that mariners may derive some little advantage from the perusal of this paper, as the writer has devoted his best attention to the subject with the sole view of rendering them, as brother sailors, a service. JOHN EVANS.

We will close this portion of our remarks with some general observations on the subject by Captain *Richard Leighton*, of Montrose, to whose kindness and talent we are indebted for numerous additions to hydrography:—

"1st. Outward-bound ships. As the S.E. storm-wind is generally nearly directly in front of the storm, on meeting with that wind and a falling barometer, &c., you should bear off freely to the north-westward, that is, nearly at right angles with the route of the gale, and all that you run that way will increase your distance from the centre when it passes you; whilst, if you run westward, you will pass so near to the centre that you will be taken aback by the wind flying into the north-westward; the object is to skirt the gale, and haul more westerly as the wind veers to the eastward.

"2nd. When the wind is to the southward of S.E., it appears that you must pass through the right-hand semicircle, and should haul to and hold all the southern that you can; lay down the bearing and distance of the centre, and as soon as practicable, by a second bearing and distance, estimate the route of the gale and its progress.

"3rd. Estimate your distance, and the course that you are likely to make, clear of lee-way, and some veering in the wind, and this will give you an idea at what distance you are likely to pass the centre, and what is likely to occur. Knowledge is power. Most carry sail long enough, but many don't set it *soon enough*.

"4th. The farther the wind is to the southward, the nearer you must pass to the centre, and as the wind veers and breaks her off, she will lay in the trough of the sea, and is most likely to get damage that way, so that if the wind gets loose, it is time to be upon the right tack (that is, the starboard tack, with westerly winds, in the Atlantic, being in the right-hand semicircle). Every one knows best what his own ship will bear, and what she will perform; however, if you *will go ahead* till the last minute, when the *barometer stops falling*, it is *high time* to have her round upon the right tack, as there is generally a tremendous gust shortly after the barometer stops falling: or, when she has made a slight rise, and the ship should be upon the starboard tack, that she may *come up* and bow the sea when she takes it.

"5th. To wait for 'the lull,' or the 'sky to the westward lighting up, to indicate the shift,' will often be *too late*.

"6th. Eight miles per hour, I think, is a fair medium for the rate of progress of rotatory gales in the Atlantic and Southern Indian Oceans. The regular West India cyclone travels generally much quicker, and some Mauritius cyclones have a very slow movement; that which the *Charles Heddle* scudded three and a half times round, only progressed about 2½ miles per hour.—*At Sea, August*, 1851.—R. LEIGHTON."

The BAROMETER will be found an unerring indicator of the approach of these meteors, provided proper attention be paid to its monitions. As a general law, the following will be its usual vibrations:—Just previous to the commencement of the hurricane, the mercury will suddenly rise above its ordinary level;* soon after it will begin to fall, and the wind probably rises, showing that the storm has begun. The mercurial column then begins to descend, rapidly at first, and then more slowly, till the centre of the hurricane has passed over, when it begins gradually to rise, and the reverse of the commencement ensues; it attains a higher level, and as suddenly falls to the mean height. This is supposing the whole of the meteor to pass over, and the centre to be crossed; the mercury showing the quantity of atmosphere above. Upon a little consideration, it will be evident that the form of the upper surface of the revolving storm, or the section of the vortex, is described by the variations in the barometric column. It by no means follows that, practically, this will always be found: a ship may only skirt the exterior of the storm, and, consequently, the mercury will only rise, or oscillate, according to the relative position of the hurricane and the ship; but it may be taken as an indication, when the barometer begins slowly to rise after being depressed, that the greatest danger has passed over, or that the ship is steering away from it. Therefore, should there be any sudden change in the barometer, either rising or falling, its indications should never be neglected, especially during the period, and in the regions, subject to these storms.† The barometer sometimes sinks *two inches* during the progress of a hurricane.—(See *Reid*, pp. 268, 271.)

The *Aneroïd Barometer* is an instrument which, if perfect in its action, would prove of infinite service to the commander in those circumstances where the limited range of pressure is indicative of such important changes. This little instrument is becoming well known. It is of the size of an ordinary chronometer. The mechanism consists of a small metallic cylinder, which is exhausted of its internal air. The sides of this cylinder are prevented from collapsing by a series of springs and levers, which latter act on a moving hand or index, showing the equivalent of the height of the mercury in an ordinary barometer. The differing atmospheric pressure on the exhausted cylinder causes its sides to close with greater, or the springs to separate them with less, external pressure, thus varying the index with the condition of the atmosphere.

One great advantage in it is, that its variations occur simultaneously with their causes. In the mercurial barometer, the friction of the mercury on the tube, and other reasons, concur to make the rise or fall at some time after the change has occurred. In this the Aneroïd barometer possesses great advantage, and it has another very great claim to notice—that it clearly shows very minute changes, which the oscillation or pumping motion of the mercury in bad weather will not allow to be estimated.

But a *caution* respecting them must be given. Like all other pieces of mechanism, they are liable to become deranged; and, as in the case of chronometers, unless some means be used to detect any variation from the correct standard, they must not be implicitly depended on. The minute comparisons of them which have been made by Professor Schumacher, Colonels Lloyd and Yorke, the United States' coast surveyors, and others, have demonstrated much irregularity and apparent caprice in their movements; so that, as a refined scientific and independent instrument, its value is very much less than was at first hoped for. It must, therefore, hold the relative value to the mercurial

* *Reid*, p. 421.

† In connexion with barometric changes, we may here advert to the constitution of the atmosphere, as mentioned on p. 136. To that statement we will add the conclusions arrived at by Professor Dové, of Berlin, from his observations. In the northern hemisphere, *the barometer* falls during E.S.E. and E. winds, passes from falling to rising during S.W., rises with W.N.W. and N., and has its maximum rise with N.E. wind.

The *thermometer* rises with E.S.E. and S. winds, has its maximum with S.W., falls with W.N.W. and N., and its minimum at N.E.

The *elasticity of vapour* increases with E.S.E. and S. winds, has its maximum at S.W., and diminishes during the wind's progress by W. and N.W. to N.; at N.E. it has a minimum.

barometer that the job-watch does to the ship's chronometer. By testing its action, and correcting its variable index errors by the ordinary barometer, it will hold a very high place among the useful instruments to aid navigation.

Colonel Reid says—"Unfortunately the barometer is supposed to foretell bad weather, whereas it only indicates that a physical change in the atmosphere has actually occurred; but this may be the beginning of a storm. From what has just been stated, it will be understood, that to mark the words '*set fair*' usually marked on barometers, is to bring this valuable instrument into disrepute, and instrument-makers should leave off the practice."*

Captain *Richard Leighton* has formed an approximate scale for the barometer, as applied to cyclone indications. Although it must be considered that each separate meteor has its peculiar features as to form and dimensions, still, if any approximate conclusions can be arrived at from apparent data, a great point is gained, when so much is involved in uncertainty.

The only method of calculating, at the presumed distance of the centre, is to construct a diagram upon the period elapsing between the first or some part of the change in the direction of the wind. This, when the ship is also in motion, becomes a more difficult problem than the leisure of the critical moment of a storm's commencement will probably allow, and the same may be said of a reference to the traverse-table, which will also apply to the case. It need be scarcely remarked, that when two or more storms coalesce, or one greater one break up into minor vortices, these and all other calculations become most complex and embarrassing. Want of space will prevent our giving the whole of Captain Leighton's remarks on this important point, but the following will suffice to demonstrate the results he has arrived at:—

"From a conviction that there exists a more intimate connexion between the height of the barometer and the distance of the centre, than between the force of the wind and the barometer, I am anxious to have *some rule* to go by, especially when you are caught in the front quadrants, and it is of great importance to ascertain, with some degree of certainty, the distance of the centre and the rate of progress of the coming storm, that you may estimate whether you have a reasonable chance of escaping by crossing the storm-path (and the path has been crossed with success, both in Bengal and Mauritius cyclones, but those of the West Indies appear generally to travel quicker than either of the former): in this case much must always depend upon the quality and condition of the ship and the judgment of her commander, to decide whether scudding be safe or not, and there can be no doubt that, with a little more certainty about the distance of the centre and the progress of the storm, a ship might very frequently be extricated from a very bad position. It must also be remembered, that all ships do not 'lay-to' equally well, and some fine ships, that would scud through almost anything, would be likely to sweep their decks if hove-to, whilst some *boxes*, that will do nothing else, will lay-to 'like a duck.'

"As a rough beginning at a barometer scale, I have taken the barometers and distances from the tables in Mr. W. C. Redfield's 'Investigation of the Cuba Storm in 1844.' Every one that is accustomed to the use of barometers knows how great the difference in the *force* of the wind is with the same range of the barometer, &c.; I have estimated this to be equal to one-tenth to each quadrant, with the same force of the wind, say No. 5 for the northern hemisphere, winds south-eastward, barometer 29·90; south-westward, 30·00; north-westward, 30·10; and north-eastward, 30·20; for the southern hemisphere it is north-eastward, 29·90; north-westward, 30·00; south-westward, 30·10; and south-eastward, 30·20; this shows the difficulty of attaching the force of the winds to the height of the barometer.

"It has been noted that the barometer, close round the Cape of Good Hope, does not fall below 29·70, although a lower barometer would be expected from the force of the winds; but, although it does not fall much, yet it falls with the same regularity, so that implicit confidence may be placed upon it; this I attribute to the distance of the centre, that it does not fall lower, because when you are further southward it does not fall lower—mine fell to about 29·14, at about 41° and 31° East. Few will dispute that it blows hard enough when the barometer gets down to 29 inches, and I think when it gets below that it may deserve the name of a storm, hurricane, or cyclone. I have before

* *Reid's Law of Storms*, p. 419.

observed that it would never do for such devastating tempests as those known as Mauritius and West India cyclones to occur so frequently as it is now proved that winds conforming to the same laws, but of a less maximum violence, do occur, and those Mr. Redfield calls *rotatory gales*. Now I think that the barometer ought to distinguish between these gales and storms, and a radius of 318 miles—and then *blowing a gale* appears too great, and this would be the case with the gales round the Cape of Good Hope. Now as there is such a marked difference in the distance when the barometer is below 29 inches, I propose, as a beginning, to assume that 28·70, and 100 miles of the following scale, represents the *centre of rotatory gales*, and when it falls below that, it may be considered as a cyclone, and in place of taking the distance less 100 miles, consider that 27·70 and 0 distance represents the centre of the cyclone.

BAROMETRIC SCALE, GIVING THE APPROXIMATE DISTANCE OF THE CENTRE OF A CYCLONE TO EVERY TEN PARTS.

Approximate Force of the Winds.	Height of Barometer.	Distance of the Centre.
No.	Inches.	Miles.
0	27·70	
	27·75	20
	28·00	46
	28·10	54
	28·20	62
12	28·30	70
	28·40	80
	28·50	85
	28·60	90
	28·70	100
0 or 11	28·80	105
	28·90	110
	29·00	115
	29·10	120
10	29·20	153
	29·30	186
	29·40	219
	29·50	252
7 to 9	29·60	285
	29·70	318
	29·80	351
4 to 6	29·90	384
	30·00	417

ON MAKING USE OF HURRICANES.

It has been proposed by Mr. Piddington to make use of these storms, by taking advantage of the favourable wind which some portions of their circumference offer for expediting the voyage. This has also been proposed by Lieutenant-Colonel Reid, in his *Law of Storms*. Mr. Piddington has given rules for this, in the regions he has made more particularly his study—the Indian and China Seas; but here the hurricanes do not appear to travel at so great a speed as those of the Atlantic.

In order to benefit by the hurricane, several conditions are necessary; and it need not be again insisted on, that any error or ignorance of the centre of rotation may be fatal. Of course the first consideration is, in what part of the circumference is the ship, and in what bearing is its centre?—then, at what rate, and in what direction, is it travelling?—and is it so violent that the ship cannot weather it? All these things must be weighed well by the mariner, before he endeavours to lay his ship on that tack which will appear the best to forward his voyage. Should the storm be advancing in the same direction as his course, and the position of the ship be upon the anterior verge, should it travel at a rate above that which he can keep up with it, it is evident that it will pass over him, and the consequences need not be remarked upon. Should the vessel be upon the posterior verge of the hurricane, it will, if travelling at 20 or 30 miles an hour, soon leave it, and then no advantage can follow.

Thus, to "make use of a hurricane," several conditions are absolutely necessary: these are—"1. The ship must get into the storm precisely where the wind blows fair for the prosecution of the voyage,—which is quite a matter of chance.—2. If she happen to do so, she must, to derive benefit, regulate her speed exactly to that of the meteor. Can she do that at pleasure? There would be no difficulty in ascertaining the fact of her preserving her station, or not, by the wind remaining steady, or veering; but there is a necessity that would bind her, and which cannot be evaded with impunity when a high sea follows;—she must carry a certain proportion of sail to prevent her from being

pooped. Now this sail may give her a greater velocity than the meteor at the time: hence she would run ahead of it. Again, the rate of the meteor may be greater than her utmost speed; hence she would be ejected."*

There is no doubt that, at times, they may aid the mariner; but, at present, we have not sufficient knowledge of the subject to lay down any fixed rules for his guidance; and therefore it must be left to his judgment, which the circumstances of the storm he experiences must actuate.

We have exceeded our intended limits on the subject of hurricanes, but its importance precludes apology. To those who desire more and better information, we recommend not only a close perusal of the disquisitions which have been quoted, but all others given in the *Nautical Magazine*, &c. The valuable periodical last mentioned contains a series of papers and tracts upon the subject, which may be taken up in order as follows:—

January, 1836;—Remarks on the Atlantic Hurricanes in general. *March*, 1836;—An impressive description of the *Centaur's Hurricane*, 29th and 30th July, 1805. *April*, 1836;—Mr. Redfield's tract, with the Routes Nos. I. to X., which have been described in pp. 118 and 120. *January*, 1837;—Atlantic Hurricanes in general, and Hurricane of the British Isles, on the 26th of November, 1836. *March*, 1837;—Atlantic Hurricanes, continued. *April*, 1837;—Theory for avoiding Hurricanes, as explained by Lieutenant Evans, in the preceding pages, with a list of the principal ones during the last 123 years. *December*, 1837;—Additional particulars of the British Hurricane of November 29, 1836.

In the number dated *January*, 1838;—Hurricanes of the 26th of July, and 2nd of August, 1837. *July*, 1838;—Hurricane experienced by the ship *Feliza*, from Jamaica to Bristol, 18th, 19th, and 20th, of August, 1837; with remarks and questions for the consideration of those who encounter Hurricanes and Typhoons. *January*, 1839;—Mr. Redfield's latter tract on the Courses of Hurricanes, noticed in page 136; also descriptions in detail of the *Hurricane over the Bahamas*, &c., 6th of September, 1838. *March*, 1839;—A re-examination of the *Raleigh's* Typhoon, by Lieutenant Evans. *July*, 1839;—Additional facts on the *Raleigh's* Typhoon, collected by Mr. Redfield. *December*, 1839;—"On the Barometer at sea, and the ill effects of scudding in a Hurricane, by Mr. J. Marshall."

May, 1843;—On the Action of the Wind. *June*, 1841;—Sailing in Circular Storms. *November*, 1843;—On the Currents of the Ocean, &c., by Mr. Redfield.

With the above should be included the disquisition of Colonel Reid, as read to the meeting of the "British Scientific Association," on the 20th of August, and of which a report may be found in the *Athenæum*, No. 565, August 25, 1838.

The Horn-Book of Storms, for the Indian and China Seas, by Henry Piddington, Calcutta, 1844; and also several papers enumerated in the above, by the same author, in the *Journal of the Asiatic Society*. Also the Report of the British Association, 1842—1844.

WATERSPOUTS.

The well-known phenomenon, called a WATERSPOUT, which is frequently seen on the Atlantic, proceeding from black dense clouds, always appears in warm weather, generally in calms, or with little wind; but they have been seen during a fresh gale. It has been shown, by the celebrated Dr. Franklin, and other writers, that a whirlwind on land, and a waterspout at sea, arise from the same general causes, and may be considered as one and the same. At sea they are commonly harmless, unless ships happen to be immediately under them; but if, in the progressive motion of the whirl, it passes from the sea over the land, and there suddenly breaks, violent and mischievous torrents are the consequence. At sea, after the spout breaks, the water descends in the form of very heavy rain. In the vicinity of a spout, the wind commonly flies round in sudden gusts; and all ships should therefore take in their square sails.

That a waterspout and whirlwind are identical, has been amply demonstrated by those who have seen this meteor pass from the sea to land, and the contrary. They have both a progressive as well as circular motion; they usually appear after calms and great heats, and mostly happen in the warmer latitudes.

* *Nautical Magazine*, 1843, p. 301.

Marine waterspouts, therefore, are caused by the action of atmospheric currents. Malté-Brun thus describes them :—"Underneath a dense cloud, the sea becomes agitated with violent commotions, the waves dart rapidly toward the centre of the agitated mass of water, on arriving at which they are dispersed into aqueous vapours, and rise whirling round, in a spiral direction, toward the cloud. This conical ascending column is met by another descending column, which leans toward the water, and joins with it. In many cases the marine column is from 50 to 80 fathoms in diameter near its base. Both columns, however, diminish toward the middle, where they unite ; so that here they do not extend more than 3 to 4 feet in diameter. The entire column presents itself in the shape of a hollow cylinder, or tube of glass, empty within. It glides over the sea without any wind being felt ; indeed, several have been seen at once following different directions. When the cloud and the marine base of the waterspout move with unequal velocities, the lower cone is often seen to incline sideways, or even to bend, and finally to burst in pieces. A noise is then heard, like the noise of a cataract falling in a deep valley : lightning frequently issues from the very bosom of the waterspout, particularly when it breaks ; but no thunder is ever heard."

In order to prevent the danger which a vessel would be exposed to by coming in contact with these tremendous columns, it is the practice to discharge upon them a cannon-ball, which, passing through them, causes them to burst, and consequently removes all chances of injury connected with them. This phenomenon is accounted for in the following manner:—Two winds meet—a vortex ensues: any cloud which happens to lie between them is condensed into a conical form, and turned round with great velocity ; this whirling motion drives from the centre of the cloud all the particles contained in it ; a vacuum is thereby produced, and water, or any other body lying beneath this vacuum, is carried into it upon the usual and well-known principle. The cannon-ball, breaking this cylinder, which is always partly hollow, causes it to fall to pieces, in the same manner as a touch upon the surface of a bubble reduces the resplendent mass to a drop of common water.

The following description of a Waterspout, seen during a fresh gale upon the coast of North America, was written by the late Mr. Murdo Downie.

"Upon the forenoon of the 9th of October, 1795, while cruizing in his Majesty's ship *Resolution*, of 74 guns (then bearing the flag of the late Admiral Murray), in company with H.M.S. *Africa*, of 64 guns, commanded by the late Admiral, then Captain, Home, in lat. 32°, and lon. 66½° W., having the wind at N.N.W. blowing a fresh gale, and the ship steering by the wind East for the Islands of Bermudas, we were surprised with a waterspout, formed in an instant, directly to leeward, at about 2 miles, or little more, distant. Both the *Africa* and we fired several 18-pound shot at it, which fell a little short ; and, although some of the shot fell very near, yet they had no visible effect upon it. Its appearance was that of a long slender pillar, with the upper end spreading into a large dense cloud, of which it seemed to form a part, and the lower end reached to within about 20 or 30 feet of the sea, where it was obscured from the sight by the water's being violently thrown up and agitated, so as to resemble a number of fountains or water-engines playing perpendicularly round the lower end of the spout. The pillar became more transparent in proportion as it decreased in size from the cloud downward, until at the lower end, where it was almost perfectly so ; and a small column, of an equal diameter, and more transparent than the rest, appeared up through the middle, so that about the lower end it resembled an empty glass tube in appearance ; from thence the transparent column in the middle became gradually obscured, the higher up, by the opacity of the outside, until it altogether disappeared near the cloud. The spout appeared at its full size, or nearly so, when first seen, and began to decrease shortly after, and turning gradually smaller, it in a short time vanished in a slight shower.

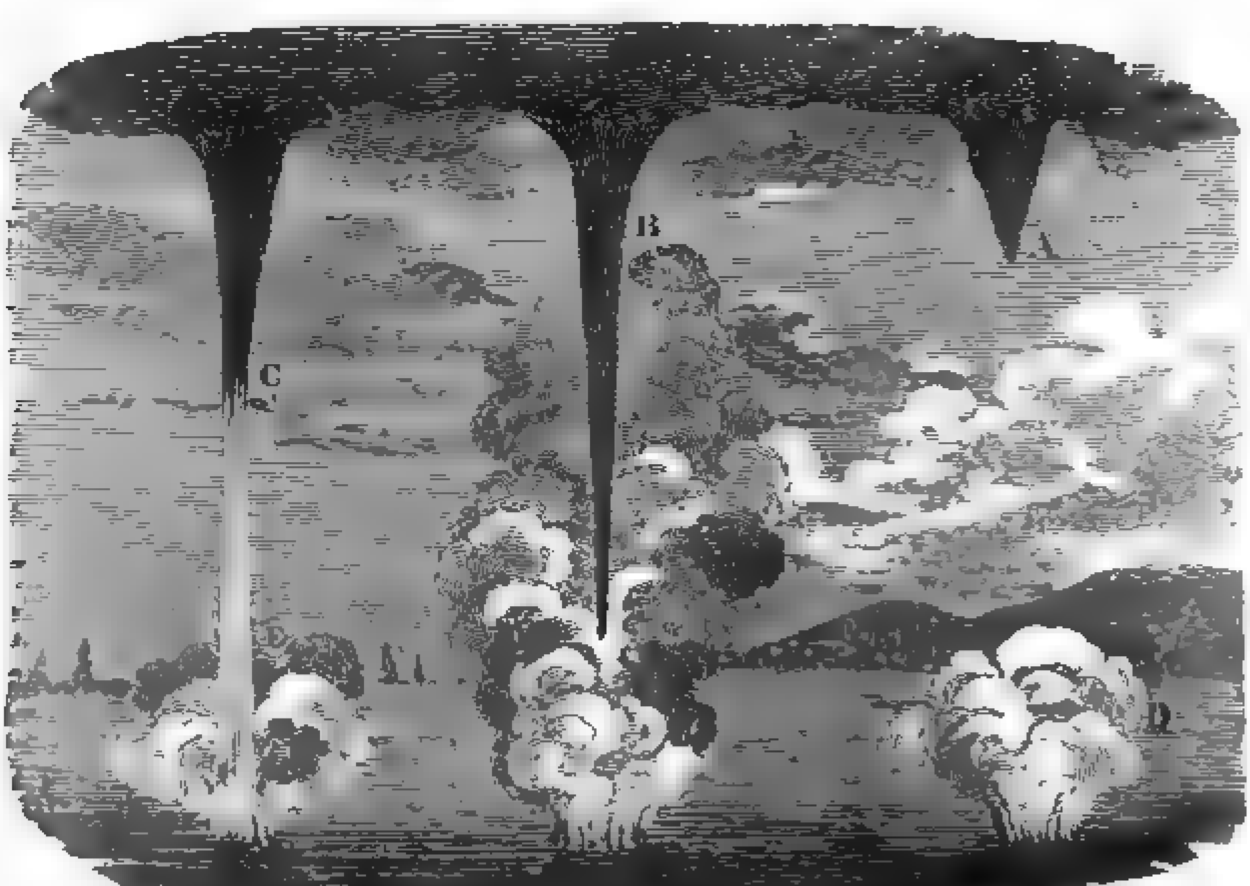
"We were too intently gazing at this extraordinary phenomenon to mark the exact time it lasted, but supposed it to continue ten or fifteen minutes ; and its distance from the ship was pretty accurately ascertained by the shot fired at it nearly reaching ; but what appeared most remarkable was, that, although the wind blew so strong a gale, that the ship could carry only reefed topsails (from which the velocity of the wind cannot be estimated at less than 30 or 40 miles an hour), yet the waterspout seemed to move but very little from the place where it was first seen. The ship was going at the rate of 5½ miles an hour, and increasing her distance from the spout ; yet, after continuing the above-mentioned time, it was considerably within the verge of the visible horizon, as seen

from the quarter-deck, when it vanished (as upon the quarter-deck the eye was elevated 23 feet above the surface of the sea, the horizon would therefore be seen about 6 miles distant): now, allowing the ship to have increased her distance from the spot half a mile during its continuance, and that it vanished a mile within the verge of the visible horizon, which, together with 2 miles it was distant when first seen, will make in all 3½ miles, which, taken from 6 miles (the distance of the visible horizon), leaves 2½ miles for the spout to move in ten minutes; whereas the wind must have gone at least 5 miles in that time, and consequently 2½ miles faster than the waterspout. Indeed it is very probable the waterspout did not move so much, in proportion to the wind, as the above calculation gives the least difference between their motions that could have been allowed from the observations: the intention of this calculation being principally to prove that the waterspout in some measure resisted the force of the wind.

"I have always observed, that waterspouts, lightning, and other electrical phenomena, are far less frequent toward the middle of the ocean than they are upon the land, or near it; and when they happen upon the sea, the cloud that contains them is generally observed to have come from off the land; from which reason we find that electrical phenomena are more frequent, and are found to reach to a greater distance, upon the sea bordering the East coast of North America, than upon that bordering the West coast of Europe; because of the prevailing westerly winds carrying the clouds charged with electric fluid off the land upon the sea near the American coast; whereas upon the European coast these winds confine the clouds upon the land. It is also a known fact, that within the limits of the N.E. trade-winds, and half-way between the Cape Verde and Windward West India Islands, more especially in the latitude of these islands, scarcely any of these electrical appearances ever happen; whereas upon the shores of Africa and America, in the same climate, they frequently rage with great fury."

DESCRIPTION OF WATERSPOUTS BY THE LATE MR. GEO. MAXWELL.

There can be no doubt that waterspouts have, in most cases, been accompanied with electrical phenomena; and it is equally certain that the spiral and ascending motion of the water has been produced by a gyratory movement in the air, arising from the meeting of two opposite winds. Mr. Maxwell had opportunities, during several voyages to the Congo, of frequently witnessing this interesting phenomenon; and in a drawing, from which the subjoined figure has been made, he has represented the different states of a waterspout, as they most commonly occur.



At their first formation, Mr. Maxwell says, they appear as at A, where the black cloud drops from a level surface into a conical form, before the disturbance at the surface of the sea, as shown at D, is observed. The effect produced at D is like that of a smoking furnace. The black conical cloud now continues to descend, as shown at B, till it almost reaches the surface of the sea, and the smoke-like appearance rises higher and higher, till it forms an union with the cloud from which the spout appears to be suspended. In this condition it is said to put on its most terrific appearance to the mariners who have the misfortune to be in its neighbourhood. When the spot begins to disperse, it assumes the appearance shown at C. The black cloud generally draws itself up in a ragged form, but leaves a thin transparent tube, C E, which reaches the water, where the smoke-like commotion still prevails. Mr. Maxwell observed, at this time, in the upper part of the tube, a very curious motion.

This singular fact, of the existence of a transparent tube, confirms a description, by Mr. Alexander Stewart, of waterspouts which he saw in the Mediterranean, in 1701. "It was observable of all of them, but chiefly of the large pillar, that toward the end it *began to appear* like a hollow canal, only black in the borders, but white in the middle; and though at first it was altogether black and opaque, yet one could very *distinctly perceive the sea-water to fly up along the middle of this canal as smoke does up a chimney*, and that with great swiftness, and a very perceptible motion; and then, soon after, the spout or canal burst in the middle, and disappeared by little and little; the boiling up and the pillar-like form of the sea-water continuing always the last, even for some considerable time after the spout disappeared, and perhaps till the spout appeared again, or re-formed itself, which it commonly did in the same place as before, breaking and forming itself again several times in a quarter or half an hour."—*Phil. Trans.*, 1702.

Captain Horsburgh, in his description of waterspouts, has said: "When a whirlwind or waterspout is observed forming at a distance, a cone may be perceived to descend from a dense cloud in the form of a trumpet, with the small end downward: at the same time the surface of the sea, under which it ascends a little way in the form of steam or white vapour, from the centre of which a small cone, proceeding upward, unites with that which projected from the cloud; and then the waterspout is completely formed. Frequently, however, the acting cause is not adequate for this purpose, and, in that case, after the waterspout is partly formed, it soon proceeds to disperse.

"There is in the middle of the cone, which forms a waterspout, a white transparent tube or column, which gives it a very dangerous appearance when viewed at a distance, as it seems like a stream of water ascending; but, when closely approached, the dangerous appearance partly vanishes. * * * * * The vacant space in the centre appears like a column of water when viewed at a distance, or like a hollow glass tube. In calm weather waterspouts generally have a perpendicular direction; but occasionally also they have an oblique or curved direction, according to the progressive motion given to them by the prevailing winds. Sometimes they disappear suddenly, at other times they move rapidly along the surface of the sea, and continue a quarter of an hour or more before they disappear.

"Waterspouts are seldom seen in the night, yet I once passed near to a large one in a cloudy dark night. The danger from them is not so great as many persons are liable to apprehend; for it has been said that a large body of water descends when they break, enough to sink a ship. This does not appear to be the case, as the water descends in heavy rain where it is broken from the ascending whirlwind. But there is danger to small vessels of being overset when they have much sail out; and large ships, if they have not their topsails clewed up and yards secured, may be liable to have them carried up to the mast-heads by the force of the whirlwind, and thereby they may lose their masts.

"When a whirlwind happens on land, all the light substances are carried up in a spiral motion by it. I have observed one pass over Canton River, in which the water ascended like a waterspout at sea, and some of the ships that were moored near its path were suddenly turned round by its influence. After passing over the river, it was observed to strip many trees of their leaves, which, together with the light covering of some of the houses and sheds, it carried up a considerable way into the atmosphere."

Captain William H. Smyth, in his interesting volume on Sicily and the Sicilian Islands, has noticed, that "waterspouts and various singular meteoric phenomena occur in that neighbourhood. Among the latter, on a warm, cloudy, and hazy day, the 14th of March, 1814, it began to rain in large drops, that appeared muddy, and they deposited

a very minute sand of a yellowish red colour. The wind, on the day before, had been blowing strongly from the S.S.W. to the N.E.; and, during the time the rain fell, was from the S.W., which leads to a supposition that it was transported from the deserts of Africa."—This remark accords with a number of others on the sand from the *Sahara* or *Desert*, which is carried by the wind over the Atlantic, to an almost incredible distance from the western coast.*

To the preceding descriptions we now annex another, as given by the Honourable Captain Napier, R.N., F.R.S.E., in 1814.

"On the 6th of September, 1814, in lat. 30° 47′ N., and lon. 62° 40′ W.,† at half-past one p.m., the wind being variable between W.N.W. and N.N.E., the ship steering S.E., an extraordinary sort of whirlwind was observed to form about 3 cables' length from the starboard bow of H.M.S. *Erne*. It carried the water up along with it in a cylindrical form, in diameter, to appearance, like that of a water-butt, gradually rising in height, increasing in bulk, advancing in a southerly direction, and, when at the distance of a mile from the ship, it continued stationary, for several minutes, boiling and foaming at the base, discharging an immense column of water, with a rushing or hissing noise, into the overhanging clouds; turning itself with a quick spiral motion, constantly bending and straightening, according as it was affected by the variable winds, which now prevailed from all points of the compass. It next returned to the northward, in direct opposition to the then prevailing wind, and right upon the ship's starboard beam, whose course was altered to East, in hopes of letting it pass astern. Its approach, however, was so rapid, that we were obliged to resort to the usual expedient of a broadside, for the purpose of averting any danger that might be apprehended; when, after firing several shots, and one, in particular, having passed right through it, at the distance of one-third from its base, it appeared for a minute as if cut horizontally in two parts, the divisions waving to and fro in different directions, as agitated by opposite winds, till they again joined for a time, and at last dissipated in an immense dark cloud or shower of rain.

"The near edge showered in large heavy drops on the ship's deck, until the cloud was quite exhausted.

"At the time of its being separated by the effect of the shot, or more probably by the agitation occasioned in the air by the discharge of several guns, its base was considerably within half a mile of the ship, covering a portion of the surface of the water at least half a furlong, or 300 feet in diameter, from one extreme circumference of ebullition to the other; and the neck of the cloud into which it discharged itself appeared to have an altitude of 40° of the quadrant, while the cloud itself extended overhead, and all around, to a very considerable distance.

"Allowing, then, from the ship, a base of little more than one-third of a nautic mile, say 2,050 feet, and an angle of 40° to the top of the neck, we shall then have, for the perpendicular height of the spout, about 1,720 feet, or very nearly one-third of a statute mile. A little before it burst, two other waterspouts, of an inferior size, were observed to the southward, but their continuance was of short duration.

"When danger was no longer to be apprehended, I observed the barometer, and found it at 30·1 inches, with the surface of the mercury very convex; an appearance which it had not assumed when at the same height at noon, about two hours before; the thermometer stood at 82°, having risen 1° since that time.

"During the continuance of the waterspout, and the subsequent rain, which might be a little more than half an hour, the wind blew from all points of the compass at different times, generally shifting at opposite points, never stronger than a fresh breeze for a moment, but in most instances quite light. It was unattended with any thunder or lightning, and the water that fell from the cloud was perfectly fresh.

"Having witnessed this extraordinary phenomenon, I endeavoured to ascertain its cause.‡

"Although this phenomenon was rather terrific in appearance, yet I am not inclined

* Colonel Reid has given, in his *Law of Storms*, a chapter (xi.) on "Waterspouts and the Smaller Whirlwinds," with several beautiful figures of the same, which have been repeated in the *Nautical Magazine*, of July, 1839.

† About 45 leagues S.E. from the Bermudas.—Ed.

‡ See *Edinburgh Phil. Journal*, vol. vi. p. 97.

to think it would have been attended with any serious calamity to the ship, had even the whole quantity fallen on board, allowing the loftier sails to have been taken in, the hatches battened down, and scuppers open. The cylinder or spout coming in contact with the masts and rigging, would naturally be destroyed; and the air rushing in, instantaneously, to restore the equilibrium, the torrent would thus be checked in its fall to the mere weight or force of a tropical descent. I have heard many reports of ravages committed by these aqueous meteors, but never yet met a person who had actually witnessed or experienced any such distressing effects."

New Providence.—A remarkable whirlwind occurred at New Providence, in 1839, which was described as follows, by the Hon. J. C. Lees, in a letter dated Nassau, March the 8th:—

"The morning had been calm, cloudy, and sultry, with occasional light puffs of wind from nearly every quarter. At about three p.m. I happened to look at the weathercock on the gaol, and saw it turn *completely* round twice in a few seconds. Immediately afterward I heard a sort of rushing, roaring noise to the S.E.; the noise was similar to the roaring when a large building is on fire. I had scarcely turned my eyes to the quarter, when I observed what, at first, I took to be smoke mingled with bushes, and I thought there had been an explosion of gunpowder; it must have been about a mile off. It advanced rapidly, however, toward me, being a column of dust and sand, intermingled with leaves and branches of trees ascending to a great height and revolving rapidly, as near as I can recollect, against or contrary to the course of the sun. It soon reached the town. The poor-house was partially injured, some small buildings raised up and knocked to pieces, trees torn up, walls knocked down, &c. There was no time to shut a window or make any preparation. A lemon tree near my house was *twisted* out of the ground; an open railed gate, made of very heavy wood, was taken off the hinges; and band-boxes, papers, and many light articles, flew out of the upper windows in *opposite directions*, as if some gunpowder had been exploded in the centre of the rooms.

"The whirlwind had travelled thus far from S.E. to N.W.: it then suddenly turned to a North or N.N.E. course, and passed down a street toward the harbour, apparently in either a serpentine or zig-zag course, knocking down every alternate house on each side of the street;* it then destroyed a long store-house, and passed into the harbour. A brig of about 250 tons, with cargo discharged, was lying near the shore. She was thrown down on her side as it passed over her. The meteor passed too rapidly over the harbour to allow time for observation on the effect it produced on the water; but, as soon as it passed over the narrow strip of land called *Hog Island*, which separates the harbour from the open sea, it formed a *Waterspout*, which passed off to the North or N.N.E.

"On looking at the houses which had been knocked down, I observed that the effect had been quite different from that occasioned by a common gale. The latter would have caused the walls, &c., to fall in *one* direction; but of these houses the four sides fell outward in four different directions, as if from an explosion within, or as I suppose they would have done from the expansion of the interior air, occasioned by a *vacuum* suddenly passing over them; and this must also have been the cause of articles above alluded to flying out of opposite windows.

"There was, at the time, no barometer in the country, and I did not notice the height of the thermometer; but as far as I can recollect, from my feelings, it must have been about 75° to 80°. I can account for the brig being thrown on her side, by supposing that she was caught by one side of the circle of wind, and, being very light, was heeled over before she had time to swing across the tide to it. She was lying East and West, and careened over to the North. The whole meteor could not have been more than 50 yards in diameter to have passed down the street in the way it did, taking down every alternate house only. There had been thunder and lightning during the day, but not much. I have seen a great number of waterspouts, far and near, and this resembled them."

* The houses are small and detached, about 20 yards apart from each other.

II.—OF THE TIDES.

As introductory to a General Table of the Tides, we shall give a few passages from *M. Malté-Brun*, explanatory of the subject; and also the results of the recent extensive observations and profound researches of *Professor Whewell* and *Sir John Lubbock*.

The water of the sea yields to the slightest impression; and, although its density and weight combine to retain it in a constant equilibrium, it is agitated to a certain depth by rapid and varied motions. These motions may be classed according to the manner in which the particles move, and according to the nature of the agents which cause the motion.

Three kinds of motion may be distinguished in the sea, considered in reference to their causes. The TIDES are *sidereal motions*, because they depend upon the influence of the heavenly bodies. *General Currents*, and the greatest number of *Particular Currents*, have their causes in the very element that is agitated by them; these, then, are *motions of the sea itself*. The third kind comprehends *atmospheric motions*, produced by the action of the winds.

The TIDES are regular and periodical oscillations, which the seas undergo from the attraction of the celestial bodies, principally those of the moon and sun.

Action of the Moon.—Let us first consider the single action of the moon upon the sea; supposing that luminary to be in the plane of the Equator. It is evident that, if the moon exerted upon all the particles of the sea an equal attraction, and parallel to the earth's centre of gravity, the entire system of the globe, and of the waters which cover it, would be influenced by a common motion, and their relative equilibrium would not suffer any change. The equilibrium is disturbed only by the difference between the attractions which the moon exerts, and the inequality of their directions. Some parts of the globe are *directly* attracted by the moon; others only obliquely. The former are in conjunction with the moon; and a line drawn from the centre of the two planets would pass through their zenith. The latter are in quadrature with the moon—that is to say, a line drawn from the terrestrial centre to their zenith would make an angle of 90° with the line which connects the centres of the two planets. The attracting force acting obliquely is decomposed by the obliquity of its angle of incidence; thus the parts in conjunction being more strongly attracted than those in quadrature, the weight of their particles is diminished. It is necessary, then, to there being an equilibrium in all parts of the sea, that the waters should rise under the moon, in order that the excess of weight of the particles in quadrature, above those in conjunction, may be compensated by the greater height of the latter.

The waters, however, rise, not only on the side where the attracting planet is, but, also, on the opposite side; because, if the planet attract the superior waters more than it attracts the centre of the earth, it also attracts this centre more than it attracts the inferior waters in the opposite hemisphere. These waters will then approach less toward the attracting planet, than the centre of the earth approaches to it. They will remain as far off, from and behind the centre, as the superior waters advance from it on the side of the moon.

Two promontories, or eminences of water, will therefore be formed by the action of the moon upon the earth;—one on the side toward the moon; the other on the side opposite to it; which gives the sea an appearance of an elongated spheroid, whose great axis will pass through the centre of the moon and of the earth. It is *high tide* under the moon and in the opposite point at 180 degrees of distance; consequently, in the two intermediate points, or at 90 degrees of distance from the moon, the tide will be *low*.

The earth, by its rotatory motion, successively presents to the moon, in the space of twenty-four hours, all its meridians, which, consequently, are found by turns, and at an interval of six hours, sometimes under the moon, and sometimes at a distance of 90 degrees from it: hence it follows that, during the time which passes between the departure of the moon from one meridian, and its return to the same meridian, that is, in the space of a lunar day, which exceeds the solar day by about fifty minutes and a half, the waters of the sea will ebb twice, and flow twice, in every part of the earth, although in a manner almost insensible in those places which are distant from the path or orbit of the moon.

Action of the Sun.—If we now imagine the sun to be in the plane of the Equator, it is evident that, as its action is similar to that of the moon, it should excite in the ocean an agitation similar to the lunar tides. Thus the sea would ebb twice and flow twice during

a solar day; but, on account of the immense distance from the sun, these solar tides will be much smaller than those which result from the action of the moon. According to *Lalande*, the influence of the moon is $2\frac{7}{10}$ times greater than that of the sun. *Laplace* considers it even triple.

On account of the inequality which exists between the solar and lunar days, the action of the sun will sometimes change the position of the lunar tides, and at other times will unite its influence with that of the moon. In the syzigies, or conjunctions, the action of the moon concurs with that of the sun to raise the waters. This is the reason why the highest tides happen at new and full moon; or when the moon is in its first or third quarters. In the quadratures, the waters of the sea are depressed by the action of the sun, at the same point where the action of the moon raises them, and reciprocally. Thus the tides of the quadratures ought to be less.

What we have already explained regards the position of the sun and moon in the Equator. Let us now consider these heavenly bodies in their various declinations, and we shall see the elevation vary in the inverse ratio of the cube of the distance of the water.

Without entering into details, which would require mathematical demonstrations, we shall remark only, that the proximity of the sun and moon seems to be the cause to which we must refer the extraordinary equinoctial tides, which happen most frequently; the one before the *vernal equinox*, and the other after the *autumnal;* that is, both of them at the time when the sun, passing through the meridional signs, is nearest us. But this does not happen every year, because there are sometimes variations produced by the situation of the orbit of the moon, and by the distance of the syzigies from the equinoxes.

This, then, is the general *Theory* of the tides, and from these observations their general laws may be inferred; but it has been reserved for later times to pursue the inquiry into detail, and to develop the minor effects which modify, and in some places totally change, the character of the tides. It is chiefly to the Rev. *Mr. Whewell*, now Master of Trinity College, Cambridge, and to *Sir John Lubbock*, that our present knowledge of the tide laws is owing, and from their observations we will give some extracts.

In the Rev. Mr. Whewell's papers on the subject of the Tides, he commences:—"Ever since the time of NEWTON, his explanation of the general phenomena of the tides, by means of the action of the moon and the sun, has been assented to by all philosophers who have given their attention to the subject. But, even up to the present day, this general explanation has not been pursued into its results in detail, so as to show its bearing on the special phenomena of particular places,—to connect the actual tides of all the different parts of the world,—and to account for their seeming anomalies. With regard to this alone, of all the consequences of the law of universal gravitation, the task of bringing the developed theory into comparison with multiplied and extensive observation is still incomplete; we might say, is still to be begun."*

The Tidal Wave.—The tidal wave is not owing to the transfer of the body of water, which would be a current, but to an *elevation* of its surface. This motion is, as readily conceived, compatible with immense velocity; and it may be taken as a rule, that the broader the wave, the greater will be its velocity. If the earth were in equilibrium, and its surface entirely covered with water, and under the influence of the moon's attraction, it would assume the form of an ellipsoid, having the semi-axis directed towards the moon longer by about 58 inches than that transverse to it; that is, the water would become higher by that amount. This is merely adduced to show what may be the amount of the luni-tidal wave, without entering into any other considerations.

Velocity of the Tidal Wave.—As the whole of the tidal wave must circulate around the globe, in twenty-four hours nearly, the velocity must be very great; but it is greatly modified. In the middle of the Atlantic it would appear to travel at the rate of about 700 miles an hour, but on the coast it is widely different; hence its velocity along the eastern coast of England varies from 35 miles to 160 miles per hour.

In the open ocean, where nothing intervenes to obstruct the course of the tidal wave, it travels probably with regularity; and it may be presumed that its height is also inconsiderable. But when this wave, from an open ocean, approaches a narrow channel, such as the Bristol or English Channel—from being hemmed in, as it were, it forms a *tide-current.* Now along the centre of such a channel the tidal wave would travel with much

* *Essay towards a First Approximation to a Map of Cotidal Lines;* Philosophical Transactions of the Royal Society, 1833, p. 147.

greater speed than on the sides. Hence the distances at which the hour-marks representing high water will be wide apart in the centre, and transverse to its general direction: while, on the shores, the direction of the wave would be altered, and it will approach parallel to the shore; hence the hour-marks will be close together, and parallel to the general direction of the main tide-current.

The tide-wave, advancing through the contracting channel, towards the end becomes of great height, and, as at Bristol, and in the Bay of Funday, sometimes rises to the enormous height of 50 or 70 feet: just in the same manner that the surf runs up a shelving beach.

The variation in the height of the tide (as is found to be the case in some parts of the coast of France), between places near each other, and having high water at the same time, is to be accounted for by the convex form of the tidal wave.

In some parts of the world, as in Australia, Kamtschatka, &c., the tides offer very singular anomalies. At Adelaide, in South Australia, it is high water only once in the twenty-four hours, and that during the night. This arises from what are called *interferences*, whereby two distinct sets of tidal waves, in their combination, produce apparent rest.*

One of the most important circumstances of this subject is, that, in an open channel, the *flood current* (the current which runs till high water) will continue running for three hours afterwards, or till *half ebb;* and the ebb current, which then begins, will run after low water till half flood. The time of slack water is intermediate between the times of high and low water. In proportion as the channel is obstructed at the further end, the flood-current runs for a shorter time after flood: and in a closed creek, the flood-current ends at high water.†

Another error to correct is this:—"That the time of the change of current, or the *time of slack water*, as it may be termed, *never* coincides with the *time of high water*, except close in-shore, and within its influence; the interval is generally considerable. Great confusion has arisen from these two times not being properly distinguished."—*Phil Trans.*, 1833, p. 162.

"*The Establishment of the Port.*—The vulgar establishment of the port is the interval of time by which the time of high water follows the moon's transit *on the day of the new and full moon.*" This is, corrected, the *mean* value of the interval, freed from the semi-menstrual inequality. Its value at the London Docks is one hour twenty-six minutes, by the mean of all the observations.—*Phil. Trans.*, 1834, p. 19.

Corrected Establishment.—The mean luni-tidal interval, or *corrected establishment* of each place, differs from the vulgar establishment, or time of high water for new and full moon; for the time of high water at syzigy is affected by the semi-menstrual inequality belonging to the moon's position one or two days earlier, and is therefore later by about thirty minutes than the mean interval would give it.‡

The Semi-menstrual Inequality.—The interval of tide and moon's transit is affected by a considerable inequality, which goes through its period *twice* in the space of one month; it may be considered as depending upon the moon's distance from the sun in right ascension, or, which is the same thing, on the solar time of the moon's transit. The difference of the greatest and least intervals at London is one hour twenty-eight minutes.§

The Age of the Tide.—The tide does not depend upon the passage of the moon upon that particular day or hour, but from some previous transit; hence the tide is observed to take place at London at two o'clock on the days of new and full moon;—therefore, as the tide of London is found to be determined by the position of the sun and moon two days and a half before it occurs, one hour twenty-six minutes is the *corrected establishment* for London, as stated above.—*Phil. Trans.*, 1831, p. 163.

Difference of the two Diurnal Tides.—It has been remarked in various places by separate observers, that the evening tide is higher than the morning tide in one part of the year, and lower at another. This is thus explained by Newton. From the vernal to the autumnal equinox the sun has North declination; and as the moon's orbit is never much inclined to the sun's, a line drawn from the earth's centre to the moon would meet the earth's surface, on the side towards the sun, in North latitude. Now, such a line is the axis of the tide-spheroid, supposing the tide to be always under the moon;

* *Phil. Trans.*, 1833, p. 154.

† *Phil. Trans.*, 1833, p. 215.

‡ *Phil. Trans.* (Whewell), 1836, p. 292.

§ *Phil. Trans.*, 1834, p. 19.

and the tide taking place when the moon in the meridian is higher, as the place is nearer to the vertices or points where the axis of the tide-spheroid meets the earth's surface. Hence, in this case, the tides which occur on the side of the earth next the sun, or the day tides, would be larger for a place in North latitude than the tides on the opposite side. For a similar reason, the night tides would be higher in winter.

Height of Mean Water.—The mean between high and low water is found to be constant and permanent, however much may be the difference of high and low water. It has been found, from a great number of observations on the South coast of England, not to vary more than 2 or 3 inches; therefore all heights ought to be referred to the *mean* level of the sea, instead of the vague and uncertain data of high or low water.*

In the *Journal of the Royal Geographic Society*, 1833, is a paper entitled, "On the Seiches of Lakes," by Colonel J. R. Jackson. The phenomenon known by the name of *Seiches* consists in an occasional rise and fall of water, in a lake or inland sea. It has often been observed in the Lake of Geneva and other lakes of the continent, and likewise in the Baltic Sea. The rise of water occurs without wind or any other apparent cause; and while the phenomenon lasts, the waters rise and fall several times in the course of a few hours. The oscillations, more or less considerable, sometimes attain the height of 5 feet, although the general maximum seldom exceeds 2 feet, and in the greater number of cases the rise is limited to a few inches. The Seiches happen indifferently in all seasons and all hours of the day, but are most frequent in the spring and autumn.

The effect seems to be produced, chiefly, by the unequal pressures of the atmosphere; particularly when it has been loaded with heavy clouds, or when the weather, in other respects serene, has threatened to be stormy, and the barometer is sunk. The Seiches rise highest in summer, and especially in the close of that season.

Should it hereafter prove that the effect described is produced by unequal atmospheric pressure, the question naturally follows,—How may this inequality of pressure locally affect the rise of the tide, the currents, *rollers*, and other inequalities of the ocean?—*Geog. Journal*, vol. iii. p. 271.

This element, in the disturbance of the regular tides, the effects of atmospheric pressure, has been estimated by different observers, and its amount has been ascertained with considerable accuracy. Thus, at Liverpool, there is a difference in the *height* of high water of 10·1 inches for a variation of 0·91 in the barometer; and at London it has been calculated by Mr. Dessiou that the water rises 6·3 inches for ·90 depression of the barometer. M. Daussay has ascertained that, at Brest, the ocean rises ·223 metre, or 8·78 inches, for a depression of ·0158 metre, or ·622 inch in the barometer.† These refinements in tidal calculations are, perhaps, of little value for the practical mariner; but they are of the utmost service in generalizing the phenomena of the tides, upon which so little, it may be said, is known that may be applied.

The foregoing are the principal effects of the causes which produce the tides, in reference to their rise and fall. There is another branch of the subject, however, which is of great importance to the navigator; that is, the currents formed by the alternate elevation and depression of the ocean. As before mentioned, in the open sea it may be considered that there is no tidal current, and that the tidal wave is propagated without any actual displacement in the particles of the water. But when this wave approaches the coast, the case is widely different, and the wave must necessarily form a current, sometimes flowing in one direction, and at others in the opposite one. This variation in the progress of the flood and ebb tide-wave must vary with every locality, and is influenced by the particular configuration of the coasts, &c., by which it passes. In general, it is found that in an open channel, as in the English Channel, the tide runs towards every point of the compass in succession, either with or against the sun; or else it runs around a portion of the circle, and then retrogrades towards its original direction. These currents, of course, cannot be generalized, as they are influenced by local and varying causes. The gyratory streams of the tide are explained and argued out in Captain M. White's *Remarks on the Winds, the Tides, and the Currents, &c.*—a work to which we shall have occasion to refer hereafter.

Upon the direction in which the great tidal wave is propagated, we at present have not sufficient knowledge to decide. It has been supposed by Sir J. Lubbock, that it

* *Phil. Trans.*, 1839, p. 154.

† *Phil. Trans.*, 1836, pp. 220, 221; and *Con. des Tems*, 1834.

travels from the Cape of Good Hope to Gibraltar in twelve hours; from Gibraltar to Edinburgh in about twelve hours; and from Edinburgh to London in about twelve hours,* which is in accordance with Bernouilli's theory. Captain White also argues for a *southerly* set of the tide along the whole of the American coasts; but it is difficult to conceive how the great *current* proceeding south-eastward from Davis Strait, and passing along the American coasts, can come under the denomination of *tides*. There are many calculations to be entered into before the actual time of high water at any place can be exactly ascertained, as will be understood by what has been before stated; and most of the times of high water that we have hitherto had, are so vague and unsatisfactory, that but little can be depended upon them for forming a complete system of the tidal phenomena.

In 1834, from the recommendation of the Rev. Professor Whewell, a series of tide observations were made, during a fortnight, in the month of June, at the coast-guard stations in Great Britain and Ireland; and in the following year a much more extensive series was taken simultaneously between the 8th and 28th of June. "The chain of places of observation extended from the mouth of the Mississippi round the Kays of Florida, along the coast of North America, as far as Nova Scotia; and from the Straits of Gibraltar, along the shores of Europe, to the North Cape of Norway. The number of places of observation was twenty-eight in America, seven in Spain, seven in Portugal, sixteen in France, five in Belgium, eighteen in the Netherlands, twenty-four in Denmark, and twenty-four in Norway; and observations were made by the coast-guard of this country at 318 places in England and Scotland, and at 219 places in Ireland." This large number of observations was also undertaken at the instigation of Professor Whewell, and their reduction was made by Mr. Dessiou and assistants, under his directions. The details and results are given in the *Philosophical Transactions*, 1836, p. 289, *et seq.*; and from them we have selected those places which, in the following table, have an asterisk attached to them, and which show the *Corrected Establishment* or true time of high water. The remainder of those here given are inserted upon the best attainable authorities; and although they may contain many incongruities, it has not been considered advisable to alter them by any empyric deductions: all corrections ought to be made from observation; and, therefore, any discrepancy must rest upon the various authorities from which this table has been constructed.

TIDE TABLE.

The following table exhibits the times of high water, with the mean vertical rise of spring tides on the different coasts of the Atlantic. A few explanatory remarks, which may be found practically useful, are annexed to each division.

British Coasts.	Time. h. m.	Rise. Feet.
London Docks	1 57	18
Woolwich	1 37	17
Nore	12 30	14
Margate Roads	12 10	16
North Foreland	11 15	17
*Ramsgate	11 1	21
*Deal	10 36	18
*Dover	11 0	17
Folkestone	10 45	20
*Dungeness	10 54	24
Beachy Head	11 19	18
*Selsea Bill	11 15	15
*Portsmouth Harbour	11 28	16
Southampton	11 35	13
Cowes	10 45	15
Needles	9 45	7

Remarks.

River Thames.— During strong north-westerly gales, the tide marks high water earlier in the River Thames than otherwise, and does not give so much water, whilst the ebb tide runs out later, and marks lower; but, upon the gales abating and the weather moderating, the tides put in and rise much higher, whilst they also run longer before high water is marked, and with more velocity of current, nor do they run out so long or so low.

The time which the flood-stream runs in the middle of the English Channel, after the time of high water on shore, is, westward of the meridian

* *Phil. Trans.*, 1836, p. 218.

	Time.	Rise.
BRITISH COASTS, *continued.*	h. m.	Feet.
*Weymouth & Portland Road	6 45	... 7
Lyme Regis	6 0	... 13
*Exmouth Bar	5 48	... 13
*Torbay	5 38	... 16
Dartmouth	6 5	... 19
*Plymouth Sound, Hamoaze, &c....	5 3	... 16
Devonport	5 33	... 20
*Fowey	4 42	... 16
Falmouth	5 15	... 18
Lizard Point	4 55	... 18
*Mounts Bay	4 19	... 20
Longships, &c.	4 30	... 20
*Scilly Islands	4 11	... 18
St. Ives, Cornwall	4 30	... 22
*Padstow	4 56	... 24
Lundy Island	5 15	... 17
Minehead	6 30	... 36
Kingroad, near Bristol ...	6 45	... 46
(*In Nov.* 1813, *by actual measurement, the tide rose* 50 *feet.*)		
St. Gowen's Head	5 50	... 24
St. Anne's Point	5 44	... 21
Pembroke Dockyard ...	6 14	... 22½
Haverfordwest	6 46	... 12
IRELAND.		
*Port Rush	6 5	7 to 8
*Rachlin Island Bay ...	7 53	... 4
*Torr Point	9 50	... 9
Belfast	10 48	10 to 12
*Port Balintrae	6 2	... 6
*Glenarm	10 28	... 6½
Larne, &c....	10 30	... 8½
Donaghadee	10 49	... 11½
Loch Strangford	10 30	14 to 16
*Portaferry	12 15	... 11
*Carlingford	10 53	... 14½
*Clogher Head	11 3	... 15
*Boyne Mouth	11 48	... 10
Drogheda Bar	10 52	11 to 13
*Lambay Island, &c. ...	11 4	... 13½
*Dublin	11 11	... 12
Kingstown Harbour	11 12	... 12
*Bray	11 23	... 10½
Wicklow	10 30	7 to 9
*Arklow	10 15	... 3
*Carnsore, &c.	5 20	... 8½
*Cahore, &c.	7 10	... 3½
*Waterford, &c.	4 48	... 12
Dunmore Head, Waterford Entrance	5 26	... 12
*Youghal	4 38	... 12
*Cork	4 37	... 14
Kinsale	4 30	... 14
*Cape Clear	4 19	... 12
*Ballinskelligs Bay	3 46	... 11

REMARKS.

of Portland, about three hours; but, to the eastward, off Dungeness, it runs to the E.N.E.ward more than three hours and a half after high water at Deal, in a north-easterly direction.

It has, until within these few years, been understood that the Channel flood-stream from the westward, and the North Sea flood from the north-eastward, met off Dungeness; but latterly tidal observations show that this meeting of the stream takes place between the North Foreland and N.E. end of the Goodwin Sands on the South, and the Kentish Knock and S.W. end of the Galloper on the North, and the place of meeting depends upon the direction and strength of the winds. But, for the particulars of the various inflections, &c., of the tide in the Channel, see the Book of *Sailing Directions*, in which they are minutely described.

During the flood, the stream off the LAND'S END, where it divides, sets from the southward to the northward nearly nine hours; and, within Scilly, it generally continues so to run about eight hours. The ebb, therefore, here runs to the southward only three or four hours; a circumstance which should be particularly attended to.

On every part of the EASTERN COAST of IRELAND, in the vicinity of *Drogheda*, or between Clogher Head and Lambay Isle, it is high water nearly at the same time, half-past ten. The flood tide comes along this coast from the southward, following the curvatures of the bays: in-shore it runs briskly, but does not extend far out to the offing. When it arrives abreast of Dundrum, it meets with the stream coming from the North of Ireland, and more or less, near St. John's Point. In consequence of this meeting of the tides, the

British Coasts, *continued.*	Time. h. m.	Rise. Feet.
Bantry Bay	4 2	... 12
Kenmare River and *Dingle Bay	3 40	... 12
*Mouth of the Shannon ...	4 12	... 12
Limerick	6 0	... 16
*Clare Coast	4 24	... 14
*Galway Coast	4 25	... 15
*Slyne Head, &c.	4 32	... 14
*Inisbofin	4 43	... 13
*Achilbeg	4 58	... 13
*Keel, Achil	4 56	... 12
*Blacksod Bay	5 10	... 12½
*Ballygloss	4 57	... 11½
*Killala Bay	5 5	... 12
*Sligo Bay	5 25	... 12½
*Donegal Bay	5 43	... 13
*Teelin Head, &c.	5 14	... 12
*Dunaff Head, &c.	5 38	... 11½
*Malin Head	5 30	... 11½

Remarks: water rises to a great height, in a heavy and turbulent sea: from hence the stream of flood comes North about, and the ebb from the southward. In the offing, the stream of tide is scarcely perceptible.

Scotland.	Time. h. m.	Rise. Feet.
Fetlar, Shetland	9 30 to 10 0	6½ to 7¾
Balta	9 58	... 6½
*Lerwick	10 59	... 10
Scalloway	9 30	... 5¾
Pentland Skerries	8 30	... 8
Sinclair's Bay	10 50	... 9
Frith of Tain	11 0	... 12
*Cromarty	11 43	... 14
Fort George	12 0	... 14
*Cowsy Point to Fraserburg	11 51	... 15
Buchan-ness	12 50	... 13
Newburg	12 58	... 13
*Aberdeen	13 13	... 14
*Stonehaven and Montrose	1 40	... 13
Tay Bar	2 5	... 16
Dundee	2 35	... 16
*St. Andrews	1 43	... 15
Fifeness	1 45	... 14
*Elie, in the Frith	1 29	... 14
Leith and Burntisland ...	2 30	... 16
Hopetown	2 35	... 17

[A copious description of the various tidal streams about the ORKNEY ISLANDS, and the coast thence to the Estuary of the Thames, is given in our *Sailing Directory for the North Sea.*]

The body of the flood in PENTLAND FRITH comes from the N.W., and its motion is perceived sooner near the land, on either side, by three hours, than in the middle of the frith, and is gradually propagated from the shores, outward, as the tide makes. The greatest velocity of spring tide in the frith is 9 miles an hour; neap tides do not run 3. When spring tide is at its greatest altitude or depression, the water continues in a quiescent state near half an hour: neap tides continue so about an hour and a half.

COAST *of* FRANCE, *in the* CHANNEL.	Time. h. m.	Rise. Feet.
*Calais	11 32	... 19
*Dunkirk	11 55	... 19
Ambleteuse	11 31	... 19
*Boulogne	11 1	... 19
Etaples	11 23	... 19
St. Vallery sur Somme ...	11 12	... 19
*Dieppe	10 43	... 19
St. Vallery en Caux... ...	10 58	... 19
Fecamp	10 48	... 19
*Le Havre de Grace ...	9 36	... 20
Honfleur	9 33	... 19
Caen and Dive...	11 3	... 19
*S. Servan...	5 54	... 34
*Chaussey I.	5 54	... 30

In the Great Bight on the West of Cape La Hague, the flood-stream, being directly opposed by the coast, and pent up by the Islands of Guernsey, Jersey, &c., accumulates to the height shown in the table: and it thus forms the stream between

Coast *of* France, *continued.*	Time. h. m.	Rise. Feet.
*Granville	5 54	37
*Barfleur	8 45	—
*Cayeux	10 53	—
Isles of St. Marcou	9 55	21½
Fort La Hogue, &c.	8 48	21
*Cherbourg	7 33	21
Guernsey	6 30	35
Alderney	6 45	35
Jersey and St. Malo	6 30	45
Mount St. Michael	6 10	54
Erqui, the Port of	6 0	40
*Bréhat	5 27	37
Treguier	5 30	32
Les Sept Isles	5 0	30
Morlaix and Isle de Bas	5 15	27
Porsal	5 0	20
Passage du Four	4 0	19
*Ushant	1 29	21

Remarks.

Cape La Hague and the Isle of Alderney, called the Race of Alderney, which sets with the velocity of 7 miles an hour. The tide hence, round Cape Barfleur, runs with rapidity: and the sea appears violently agitated about that cape.

Bay *of* Biscay, *and thence to* Gibraltar *and* Malaga.	Time. h. m.	Rise. Feet.
Roads of Bertaume, St. Mathieu, and Conquet	3 0	21
Bay of Brest	3 30	21
*Brest	3 25	21
Road of Dovarnenéz	3 38	21
Bec du Raz	3 35	21
*Lambrille, I. de Sein	3 39	—
*Abrevrak	7 25	—
Port l'Orient	3 43	20
Blavet or Port Louis	3 32	19
Mouth of the Loire	3 50	19
Isle of Oleron, and Entrance of the R. Charente	3 50	19
Basque Roads	3 45	20
Rochefort	4 20	21
Entrance of the Gironde, and Bassin de Arcachon	4 18	16
Bayonne	3 15	16
*Bilboa	2 53	—
*Santander	3 30	—
*Ferrol	2 29	—
*Camariñas	2 22	—
On the Coast, between Cape Finisterre and Cape St. Mary, and at the Entrance of the Rivers, generally about	3 0	13
In the Ports and Harbours of the same, generally	3 45	—
*Vianna	1 56	—
Bay of Arosa	3 45	12
*River Douro; Entrance	2 30	10
*Lisbon	4 0	—
Setubal	4 30	—
*Peniche	1 54	—
*Cascaes	1 29	—
*Sines	2 1	—
Lagos, Bay	2 7	13
Cape St. Vincent and Faro	2 15	—

On the coasts of the bay, at sea, it flows generally at three o'clock, and the vertical rise is from 19 to 15 feet, as shown in the Table.

[For a description of Quiberon Bay, the Road of Basque, Bayonne, and the Coast of Spain, &c., see Section III. hereafter: or, more particularly, the new Book of *Directions for the Bay of Biscay, &c.*, lately published by Mr. Laurie, &c.]

In the middle of the Strait of Gibraltar, the *current mostly* and generally sets to the East: but, on each side, the flood tide sets to the westward. On the European side, West of the Isle of Tarifa, it is high water at eleven o'clock, but the stream without continues to run until two o'clock. On the opposite shore of Africa, it is high water at ten o'clock, and the stream without continues to run until one o'clock: after which periods it changes on either side, and runs eastward with the general current. Near the shores are many changes,

	Time.	Rise.
Bay *of* Biscay, *&c. continued.*	h. m.	Feet.
Coast from Cape St. Mary to the Strait of Gibraltar...	2 0	... 10
Tavira, Ayamonte, and Lepe	1 30	... —
Guelba and Palos	12 40	... —
San Lucar	2 0	... —
Cadiz	1 40	... 9
Puntal of Cadiz	2 15	... —
Tarifa Island	12 0	... 8
Gibraltar	12 15	... —
*Algesiras	1 34	... —
Malaga...	12 0	... 3

Remarks.

counter-currents, and whirlpools, caused by, and varying with, the winds.

Near Malaga, the stream runs along-shore, about six hours each way. The flood sets to the westward.

Coasts of Africa.	Time.	Rise.
*Ceuta	1 55	—
Along the Coast of Morocco, from the Strait of Gibraltar to Cape Cantin...	1 30	9 to 10
Suerrah or Mogodor	2 0	... 10
Cape Geer or Ghir	2 15	... 10
Cape Boiador or Bojador ...	12 0	... —
Cape Blanco...	11 45	... 6
Bar of the Senegal	10 30	... —
Cape Verde	7 45	... 3
Goeree	7 48	... 4
Bathurst, at the Entrance of the Gambia	8 10	6 to 8
Great Channel of Bissagos...	9 15	... 8
East End of Bulama Island	4 30	... 15
Ilhas dos Idolhos, or Isles de Los (*flood to the N.*) ...	6 35	12 to 17
Matacong Island	7 40	... 11
Scarcies River; Entrance ...	7 10	... 10
River Sierra Leone	7 50	10 to 12½
Bananas Isles	8 15	8 to 10
Sherbro River	6 0	... 11
Along the Coast of Guinea, at sea, generally the vertical rise is about 3½ feet; and in the mouths of rivers, 5, 6, and 7 feet.		
Cape Coast	3 30	6 to 7
Lagos	4 0	... 6
River Benin; Entrance ...	4 15	6 to 8
Mouth of New Calabar River	5 30	6 to 9
Entrance of Camaroens River	6 0	6 to 8
Corisco Isle	5 0	... 7
River Gabon or Gaboon ...	6 0	... 8

The currents on the African coast (hereafter explained) render the given times of high water uncertain.

Between Cape Cantin and Cape Blanco they are strong, and set as shown on the Chart.

In the road without the Senegal, the current sets chiefly to the S.W. From the bar, strong freshes come down after the rains, and a powerful current of fresh water sets from the river to some distance out to sea.

In the Bay of Yoff, to the N.E. of Cape Verde, the currents set rapidly, and sometimes in very dangerous whirls.

At the mouth of the Gambia the greatest rise in the dry season is not more than 6 feet. Here the tide continues to run on the surface for an hour and a half after it ceases flowing on shore.

The level of the sea, in the vicinity of Cape Coast Castle, is higher, by at least 6 feet, in the rainy season (which is the season of the strong S.W. and southerly winds, between April and September), than in the more serene weather of the dry season.

In the rainy season, or S.W. monsoon, trunks of trees are frequently carried on shore, and found at 6 or 8 feet above the level of the sea, of the other season; and the tides *ebb* and *flow* regularly in the several rivers; but, in the dry season, the same rivers run ebb constantly; the level of the sea being then too low to allow the tide-waters to enter the mouths of the rivers.

Some Remarks on the Tides about Cape Blanco, the Channels of the Bissagos, &c., are given in the Description of the Coast, Section III. hereafter.

THE ATLANTIC ISLANDS.	TIME. h. m.	RISE. Feet.
Azores.—Ponta Delgada, St. Michael's	2 15	7
Angra, Terceira	2 30	6
Fayal	2 15	4½
Madeira.—Funchal	12 10	8 to 9
Canaries, in general. About	3 0	8 to 10
CapeVerde Isles.—St. Nicholas	7 0	6
Port Praya	6 0	5
English Road, Bonavista	7 30	5
Bermudas.—St. George's	7 0 to 8 0	5 or 6

REMARKS.

These may be considered as a general mean; but the rise and time vary according to the winds, &c.

On the South side of St. Michael's the tide is regular, and the flood sets to the eastward. In the offing it continues three hours later than on shore.

At the Bermudas the tides vary in different parts of the islands. Common tides rise only 4 feet.

STRAIT *of* BELLE ISLE, NEWFOUNDLAND, &c.	TIME. h. m.	RISE. Feet.
Coast of Labrador and Strait of Belle Isle, generally	11 30	7
Red Bay, Labrador	7 45	3½
Bradore Harbour	8 45	4
Little Mecattina	10 30	5
New and Old Ferolle	11 45	—
Bays of St. Genevieve and St. Barbe	11 30	—
Isle Verte, or Green Island	9 0	—
Bay of Pistolet	6 45	5
Croque Harbour	6 30	6½
Triton Harbour, in Notre Dame Bay	6 0	6
St. John's	7 30	5 to 7
Placentia Harbour	9 15	8
St. Pierre and Miquelon	9 0	6 & 7
Between Cape Chapeau Rouge and Cape Ray, generally	9 0	7 & 8
Beyond Cape Ray, northward, the tide is inconsiderable.		

On all the coasts of Newfoundland the tides are very irregular; being greatly influenced by the prevailing wind. On all the eastern coast they have nearly the same rising; springs about 6 feet; neaps 4. At the entrance of St. John's they set in a bore.

Between Cape La Hune and Cape Ray the flood sets to the westward in the offing, very irregularly, but generally two or three hours after high water on shore. See more particularly our *British American Navigator, &c.*, published by Mr. Laurie.

RIVER *of* ST. LAWRENCE.	TIME. h. m.	RISE. Feet.
CAPE CHATTE or Chat	12 0	13
River Matane; Entrance	2 0	12
Grand Metis	2 10	13
Isle Bic	2 15	12
Green Island	2 45	9½
Brandy Ports	3 30	—
Kamouraska Isles	4 0	—
The Traverse	4 30	17
Isle aux Coudres	4 25	—
Within the Pillars	5 0	—
Crane Island	5 20	17½
Orleans Island; East End	5 32	—
QUEBEC	6 38	18
North Coast of the River.		
Tadousac	2 45	17
Port Neuf	2 10	14
Point Mille Vaches	2 0	—
Bersiamities Point	11 0	12
Manicouagan Bay	2 6	12
St. Nicholas Harbour	12 0	12
Point de Monts	12 0	12

At 3 leagues below *Tadousac*, or the *Saguenay*, is the eddy of the flood, and the stream on the

From Green Island to Quebec the tides rise irregularly, but vary considerably. From Coudre to Quebec the water falls 4 feet before the tide makes down. At the Isle of Coudre, in spring tides, the ebb runs at the rate of 2 knots. The next strongest ebb is between Apple and Basque Isles; the ebb of the River Saguenay uniting here, it runs full 7 knots in spring tides; yet, although the ebb is so strong, the flood is scarcely perceptible; and below the Isle of Bic, there is no appearance of a flood tide.

surface always sets thence downward. Off Tadousac, the tide ebbs six hours fifteen minutes, and flows six hours eight minutes. Both streams here run three quarters of an hour after high and low water. At Green Island, it ebbs six hours twenty-four minutes, and flows six hours.

At the Isle aux Coudres, it ebbs six hours twenty minutes, and flows six hours. Here the ebb stream continues an hour and a quarter after low water, and the flood three quarters of an hour after high water. Within the Pillars, off St. Jean, the tide ebbs six hours fifty minutes, and flows five hours twenty-five minutes. Both streams continue to run an hour after high and low water by the shore, but they are influenced in duration by strong winds.

At the Isle of Orleans, the stream ebbs seven hours, and flows five hours twenty minutes. At Quebec, it flows four hours forty-five minutes only, but runs an hour longer as above.

	Time.	Rise.	Remarks.
Gulf *of* St. Lawrence.	h. m.	Feet.	
Seven Islands Bay	1 40	9	On the South side of Prince Edward Isle the tides are regular, but they are very irregular on the North. The tide of the Gut of Canso generally sets in from the southward, but is very irregular, being influenced by the winds. After strong N.W. winds, the water in the Gulf of St. Lawrence is rendered low, which causes the stream to run northward, through the gut, at the rate or 4 or 5 miles; the contrary happens with southerly winds.
Mingan Islands	1 30	7	
Eastern Mingans	11 30	5	
Kegashka	10 45	5	
Gaspé Bay	1 50	5	
Ristigouche Harbour; Campbell Town	4 0	10	
Cocagne to Cape Tormentin, and thence to Pictou Harbour	7 0	6	
Gut of Canso	8 0	8	
Pr. Edward Isle.—Charlotte Town	10 45	9	
Magdalen Isles	8 20	3	
Breton Island, Nova Scotia, &c.			
Jestico or Port Hood	9 0	6	Off Cape Sable the tide runs at the rate of 3, and sometimes 4, miles an hour; and in the Bay of Fundy the tides are very rapid. Cape D'Or and Cape Chignecto are high lands, with very steep cliffs, and deep water close under them. The same kind of shore continues to the head of Chignecto Bay, where very extensive flats of mud and quicksands are left to dry at low water. Here the tides come in a bore, rushing in with great rapidity: they are known to flow at the equinoxes from 60 to 70 feet perpendicular; and it is remarkable that, at the same time, they rise in the Bay Verte, on the northern side of the isthmus, only 8 feet. In the Harbour of St. John, the tide of flood is weak, but the ebb runs very rapidly.
Sidney Harbour	9 0	6	
Louisbourg	7 15	5½	
South Shore of Madame I.	8 0	8	
Ship Harbour in Gut of Canso	8 0	8½	
Chedabucto Bay	8 30	8	
Sable Island, North Side	10 30	7	
——— South Side	8 30	8	
Canso Harbour	8 45	7	
Torbay	8 45	8	
Country Harbour to White Island Bay	9 0	8	
Beaver Harbour	8 45	7	
Spry Harbour	8 30	7½	
Halifax to St. Margaret's Bay	8 0	8	
Mahone Bay to Liverpool Harbour	8 0	8	
Shelburne Harbour	8 30	8	
Cape Sable	8 0	9	
Cape Fourchu	8 45	13	
Cape St. Mary	9 0	14	
Bay of St. Mary	9 30	16	
Gut of Annapolis. Entrance	10 0	28	

Breton Island, Nova Scotia, &c., *continued.*	Time. h.	Time. m.		Rise. Feet.
Cape D'Or; Entrance of Mines Channel	11	0	...	41
Basin of Mines, viz.:				
Windsor	12	0	...	36
Seven Isles Harbour	11	0	...	31
Cape Split	11	15	...	40
Apple River; Chignecto Bay	11	0	...	32
Cumberland Basin; Fort	12	0	...	60
Shepody Bay	11	30	...	48
St. John's, New Brunswick	12	0	...	25
Passamaquoddy; North Bay	10	45	...	30

Remarks.

See further, with regard to the Tides of the Bay of Fundy, the *British American Navigator*.

United States.

	Time. h.	Time. m.		Rise. Feet.
*East Port, Maine	11	13	...	23
Machias	11	0	...	12
Mount Desert	11	10	...	13½
Penobscot River and Fox Isles	10	45	...	9
Townsend, Broad Bay, and George's River	40	45	...	9
Kennebeck and Sheepscut	10	45	...	9
*Gloucester	11	59	...	12½
Portland	11	10	...	12
Newbury Port	9	45	...	12
*Portsmouth	11	30	...	10½
Marble-Head, Salem, and Cape Anne	11	30	...	11
Boston	11	31	...	14½
Plymouth and Monomoy Point	11	30	...	6
*Cape Cod	11	25	...	12½
*Province Town	11	27	...	12½
Race Point	11	28	...	—
Shoals of George's Bank	10	30	...	7
Nantucket Shoals	10	45	...	—
Nantucket Harbour	12	31	...	6
*Warren	8	5	...	6½
*Gardiner's Bay	9	55	...	3½
Tarpaulin Cove; Elizabeth Isles	8	52	...	5
Gay Head; New Bedford, and Block Island	7	37	...	5
*Newport	7	39	...	6
Off Newhaven	9	0	...	8
New London, and Elizabeth Town Point	8	54	...	6
Sandy Hook, New York	7	35	2½ to	7
*New York Navy Yard	8	37	...	6½
Cape May	8	45	...	6
*Gosport, Virginia	9	0	...	4½
*Delaware Breakwater	7	35	...	6½
*Old Point Comfort	8	27	...	3¾
Cape Henry	10	0	...	4½
*Cape Fear River	7	14	...	7
*Cape Hatteras	5	43	...	5½
Hampton Road	10	30	...	4
Charleston, South Carolina	7	21	...	8
*Savannah	8	9	...	8½
Port Royal	8	15	...	6
St. Simon's Sound	9	0	...	6

At Mount Desert Rock the stream of flood divides to run eastward and westward. With the Skuttock Hills about N.N.E., and within 4 or 5 leagues of those of Mount Desert, the flood stream sets E.N.E., and the ebb, W.S.W.; but, at the distance of 9 or 10 leagues from the land, the current, in general, sets to the S.W. and more westward. From the Mount Desert Rock to the Fox Islands, at the entrance of the Bay of Penobscot, the flood stream sets W.S.W. along shore; but it, nevertheless, runs up to the northward into Isle Haute Bay, &c.

Nantucket has a tide hour much later than the surrounding seas.

At Sandy Hook the stream of tide continues to set in at the rate of 2 knots, until nearly nine o'clock.

The tides in the rivers of the Chesapeake are varied by the winds. When it blows two or three days at N. or N.W., the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The times of high water in the Chesapeake have been given as follows: Lynhaven Bay, or South side, ten o'clock; East shore, within Cape Charles, twelve o'clock; Mouth of the Rappahanock, three o'clock; of the Potomac, half-past three o'clock; of the Patapsco, or Baltimore River, three-quarters past seven.

In the vicinity of Charleston and Savannah, N.E., easterly, and S.E. winds cause higher tides than the other winds, and also vary their course. At about 6 leagues from the land, off Port Royal, in 12 fathoms of water, the flood sets strongly to the southward, and the ebb northward.

	Time.	Rise.	Remarks.
	h. m.	Feet.	
United States, *continued.*			
St. Simon's Bar	7 30	... 6	At a great distance from shore no tide is perceptible.
St. Simon's Offing...	6 45	... —	
St. Mary's Bar	8 15	... 7	
Nassau Bar	7 30	... 7	
Bar of St. Augustin	8 4	... 6½	
Hillsborough Inlet...	7 30	... 5	
Nassau, New Providence ...	8 20	... 4	Although, at the Bahamas, the rise and fall are inconsiderable, the tide of flood sets an indraught on the northern part of the Little Bahama Bank from every point of the compass, which renders an approach very dangerous.
South End of Abaco	8 0	... 3	
Florida Kays; Sombrero Kay	8 0	... 5	
*Kay West, Florida	9 53	... 2½	
Dry Tortugas...	8 30	... 3	
Chatham Bay to Cape Roman (very irregular)	— —	... 2	
Mouths of the Mississippi ...	— —	... 1½	

The tide sets with some force directly on and off the western side of the Grand Bank of Bahama; particularly at the full and change of the moon. High water at half-past seven or thereabout. Rise, 3 to 4 feet. On the Middle Ground of this bank the tides set in every direction.

In Providence N.W. Channel the current runs generally to the eastward, about 2 miles an hour.

Near Egg Island, to the N.W. of Eleuthera, it is, however, uncertain, and great attention should be paid to the lead. In the passage within Egg Island the tide runs at the rate of 4 miles, and rises above 4 feet; the flood setting eastward, and strongly over the reefs.

About the Berry Islands and Providence the water rises 2 feet higher when the sun comes to the northward of the line, than it does when the sun is to the southward, and its strength is in a similar proportion. Here and at the Bemini Isles the flood sets to the N.E.

Near Cayo Hueso, now Kay West, on the Florida Reef, the tides are, in some measure, regular within the reef: the flood setting to the westward, and the ebb contrary. To the westward, between the Tortugas and Cayo Marques, the flood sets variably through to the northward, and ebbs to the E.S.E.

It is remarkable that, on the South side of these kays, the flood comes from the S.E.ward; but on the North side of them, all the way from Cayo Hueso, the flood runs to the eastward, along the edge of the bank, and to the southward, through the little channels, in order to fill up the intermediate bays and lagoons, with the assistance of the flood from the southward.

Westward of Kay West there is a general current to the S.W.ward, along the reef, and to some distance to the South side of it.

In Ponce or Chatham Bay it runs tide and half-tide; viz., three hours flood, then three hours ebb: next, nine hours flood, &c. Here, in some places, it is a mere fall; but in some of the channels it is as much as four men can do to stem the current with a boat.

During a S.E. gale or storm the water in the bays and rivers of West Florida has been known to rise 7 feet perpendicular, and vessels of burden have been driven in, among the pine trees, at some distance from shore.

From Cape Roman, northward and westward, the tide seems to ebb and flow only once in the twenty-four hours; but it is irregular, and much governed by the winds. Yet the effects in a dry season are very perceptible in the rivers at a distance from the sea.

III.—OF THE CURRENTS.

A CURRENT is at present to be understood as that *atmospherical* motion of the water which has been already noticed: in other words, as a stream on, or a particular set in the direction of, the surface of the sea, occasioned by winds and other impulses, exclusive of (but which *may be influenced by*) the causes of the tides. It is an observation of *Dampier*, that CURRENTS are scarcely ever felt but at sea, and TIDES but upon the coasts; and it is certainly an established fact that *currents* prevail mostly in those parts where the tides are weak and scarcely perceptible, or where the sea, apparently little influenced by the causes of the tides, is disposed to a quiescent state. This will be obvious by an attentive consideration of the following descriptions. The necessity of attention to the silent, imperceptible, and therefore dangerous operation of currents, will be equally apparent.*

OF THESE CURRENTS there are two distinctions:—1. The *Drift Current:* 2. The *Stream Current.*

The DRIFT or DRIFT CURRENT is the mere effect of a *constant* or *very prevalent* wind on the surface water, impelling it to leeward until it meets with some obstacle which stops it, and occasions an accumulation and consequent *stream* of current. It matters not whether the obstacle be *land*, or *banks*, or a *stream of current* already formed. The drift current is generally shallow, and at a mean, perhaps, of no more than half a mile an hour, when the wind is constant and a good breeze. Such a current, from a predominance of westerly winds, occupies the northern region of the Atlantic, from the N.W. and West to the E.N.E. and S.E.; and such, likewise, is the central portion of the ocean under the influence of the trade wind.

The STREAM CURRENT is formed by the accumulated waters of a *drift current.* It is more limited, but it may be of any bulk, or depth, or velocity. Of such is the temporary stream setting at times from the Bay of Biscay to the West of Ireland; and of such is the *Florida* or *Gulf Stream*, setting from the Mexican Sea to the Banks of Newfoundland, and terminating to the West of the Azores.

In some parts the current is compounded of *drift* and *stream;* for a *stream*, already formed, may pass through the region of a prevalent wind, in a direction according with that of its *drift* current, and receive an acceleration of motion from it accordingly. Of such is the Equatorial Current, which will be presently noticed.

Of the currents of the Atlantic, the first in order, from the Land's End of England, is RENNELL'S CURRENT, a temporary but extensive stream, which sets at times from the Bay of Biscay to the westward and N.W., athwart the entrance of the English Channel, and to the westward of Cape Clear.

Second.—The ARCTIC or GREENLAND CURRENT; with EASTERLY and S.E. DRIFT CURRENTS to the coasts of Europe and Africa, and southerly to the Coast of Guinea.

Third.—The AFRICAN or GUINEA CURRENT, an easterly stream along the coast of Africa, into the Bights of Benin and Biafra, with a westerly outset from the same.

Fourth.—The CENTRAL or DRIFT CURRENT, between the Azores and Bermudas, &c., generally to the W.S.W.

Fifth.—The EQUATORIAL CURRENT, a vast stream passing over the Equator from the E.S.E.; thence dividing into two great branches, of which the western forms the main stream; the eastern partaking more of a drift, and proceeding to its highest northern parallel, when the N.E. trade fails most remotely from the Line. The western branch runs to the W.N.W. and N.W. to the Caribbean Sea; the eastern more to the North; and, *at times*, even N.N.E. and N.E. to the Cape Verde Islands.

Sixth.—The CURRENTS of the COLOMBIAN or CARIBBEAN SEA, and the MEXICAN STREAM, an inset into the Mexican Sea, from the south-eastward.

Seventh.—The FLORIDA or GULF STREAM, an outset from the Mexican Sea, setting thence to the north-eastward, through the Strait of Florida, and thence eastward toward the Newfoundland Bank and Azores.

* The streams of tide probably extend much farther from land than is generally supposed; at least it has appeared so, from numerous sidereal and chronometric observations, which I could by no other means reconcile than by supposing the vessel to be affected by tide.—*A. L.*

This remark seems to have been corroborated by the Baron Roussin, on the coast of Western Africa.—ED.

Eighth.—The STREAMS of NEWFOUNDLAND and ST. LAWRENCE, setting from the North and N.E., and from the River and Gulf of St. Lawrence around Breton Island, to the southward and S.W.

In explaining this subject, we shall endeavour, in the first place, to establish the facts which prove the existence of these currents, and then attempt to deduce the causes, according to the given descriptions.

1.—OF RENNELL'S CURRENT; OR THE CURRENT ATHWART THE ENTRANCE OF THE ENGLISH CHANNEL.

This current, which is occasionally of considerable breadth and strength, frequently sets athwart the entrance of the Channel to the N.W. and W.N.W. at some distance to the westward of the Isles of Ushant and Scilly. As it apparently depends on temporary circumstances, it is considered as a temporary stream; and, although a certain quantity of northerly indraught is always to be allowed for, with the tide of flood, on approaching the Scilly Islands, the current, unless with particular winds on the ocean, will be scarcely, if at all, perceptible.

The general causes of currents, so far as they depend upon the state of the winds, &c., are generally known to seamen; and that a long-continued wind, in one particular direction, will either produce a stream where no obstruction exists, or causes an accumulation of the water against an opposing coast, until a reverberation takes place, needs no demonstration. The latter appears to be the case in the present instance. A long and continual prevalence of westerly and south-westerly winds, in combination with a current, that commonly sets into the southern part of the Bay of Biscay, occasions an accumulation of water in the Bay, which seeks an escape, by setting to the N.W. or W.N.W., within the limits described by the half-arrows in the accompanying Chart.

It would be very difficult to understand how that the great preponderance of winds from the westward of North and South, which prevail in the latitudes of Cape Finisterre, should not have some effect in forcing the water toward the coast; and if so, what can become of it, unless it forms some current, which we should very naturally expect to find would follow the trend of the coast against which it is propelled.

That such a current does actually prevail, is too well known to be longer doubted. Mr. KELLY, the author of a treatise on Navigation, published near a century ago, has given a particular instance of it: by which he shows that a ship becalmed, with her sails furled for forty-eight hours, was in that time carried by the current 46 miles to the northward;* and we have many subsequent examples of vessels which have been set, by the course of the stream, to the northward, or upon the rocks, of Scilly. But the writer to whom we are more particularly indebted for an elucidation of the subject, is the late Major RENNELL,† who has given an illustration of it, which places it beyond all controversy;

* Had observations for the longitude been made, it is probable that the current would have been found also to have set westward. See further, hereafter.

† From the name of this gentleman, the current is now generally denominated RENNELL'S CURRENT.

The currents of the ocean appear to have attracted the attention of Major Rennell at an early period, and they continued to occupy that attention until the last ebb of his honourable life. The results have appeared before the world in five large charts, with a descriptive volume, dedicated to his late Majesty, William the Fourth.

The Major's first Chart and Remarks on the Agulhas or South African Current appeared in the year 1778, and the important tract on the Scilly or 'thwart Channel Current, in the year 1793. In the mean time, and subsequently, some cursory remarks on the same subject were introduced in the "Illustration of the Geography of Herodotus," the Philosophical Journals, &c. In or about the year 1810, on the suggestion of a friend, who expressed a wish to see all his writings on this subject combined and republished, he commenced his *Current Charts of the Atlantic Ocean*, and collected from the journals of his numerous friends a gleaning of information which, at length, from repeated accumulations, presented a most beautiful and singular instance of successful perseverance, on a subject never before attempted upon a plan so comprehensive. To an ordinary mind such a topic would have been regarded as dull, uninviting, and *impracticable;* by the author it was appreciated according to its importance and usefulness

and from whose paper, published in the *Philosophical Transactions* of the year 1793, we abstract the following observations:—

"In crossing the eastern part of the Atlantic, the *Hector*, East India ship, Captain Williams, in 1778, encountered, between the parallels of 42° and 49°, very strong westerly gales; but particularly between the 16th and 24th of January, when, at intervals, it blew with uncommon violence. It varied two or more points, both to the North and S.W., but blew longest from the northern point; and extended, as subsequently appeared, from the coast of Nova Scotia to that of Spain.

"Within 60 or 70 leagues of the meridian of Scilly, on the 30th of January, between the parallels of 49° and 50°, the effect of the current was first experienced, which set the ship to the North of her intended parallel, by nearly half a degree, in the interval between two observations of latitude; namely, in two days. The wind, ever afterward, prevented the ship from regaining the parallel; for although the northern set was trifling, from the 31st until she arrived near Scilly, yet the wind, being scant and light, never enabled her to overcome the tendency of the current. It is also to be observed, that the direction of the current was much more westerly than northerly; the ship crossed it on so very oblique a course as to be in it a long time, and was driven, as it appears, nearly 30 leagues to the West by it; having soundings in 73 fathoms, in the latitude of Scilly, and afterward ran 150 miles by the log, directly East, before she reached the length of the islands; running, in effect, 120 miles, and shallowed the water only 9 fathoms.

"The current was not only sensible by the observations of latitude, but by ripplings on the surface of the water, and by the direction of the lead line. In consequence of all, the ship was driven to the North of Scilly, and barely able to lay a course through the passage between those islands and the Land's End.

"There being no timekeeper on board, the longitude was uncertain; but it was concluded that the current, at times, extends to 60 leagues West of Scilly, and runs close to the West of the islands. The breadth of the stream, where the *Hector* crossed over it, was supposed to be about 30 leagues.

"A journal of the *Atlas*, East India ship, Captain Cooper, furnishes much clearer proofs, both of the existence of the current, and the rate of its motion. This ship, outward bound, in January, 1787, had advanced 55 leagues to the westward of Ushant, when violent gales began at South, and for four days continued between that point and W. by S.; during which time the ship was lying-to, with her head to N.W. On the fifth day the wind abated, but was S.W.; stormy weather then ensued for nine days, the wind blowing from all points between South and S.S.W., but chiefly, and most violently, from W.S.W. and S.W.; and when the ship then proceeded southward on her voyage, she was, by the reckoning, only 2¼ degrees of longitude West of Cape Finisterre; but, by timekeepers, more than *four degrees and a half.*

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to mankind, and he treated it accordingly. He had long lamented the general ignorance prevalent on this subject, and which had, from time to time, produced so much loss of life and treasure, especially in relation to his native country. It is true that, in later times, practice and experience have taught the mariner, in many cases, how to shape his course to the best advantage; but still he was deficient in *theory*, and knew not the *rationale*, the *why and wherefore,* of the courses which he adopted, and the variations which might be most advantageously made in his outward or homeward passages, according to the fluctuations of season and circumstances. Such knowledge is now, in a great measure, supplied.

Among the names of the contributors to the work on the currents, that of Captain *Edward Sabine* is conspicuous; and were any apology required for the undertaking, his words might be quoted with propriety. In the year 1825, this gentleman published his *Account of Experiments to determine the Figure of the Earth by means of a Pendulum vibrating Seconds in different Latitudes, as well as on various Subjects of Philosophical Enquiry;*" and in that volume he has given his testimonial of the necessity of the "Investigations" in the following terms.

"On a general review of the currents particularized on the *Pheasant's* progress (in 1822) in her voyage, commencing at Sierra Leone and terminating at New York, it was found that she was indebted to their aid, on the balance of the whole account, and in the direction of her course from port to port, not less than *sixteen hundred geographic miles,* the whole distance being nine thousand; affording a very striking exemplification of the importance of a correct knowledge of the currents of the ocean to persons engaged in its navigation: and consequently of the value of the information in the acquisition and arrangement of which Major Rennell has passed the latter years of his most useful life."

"On the day the gales commenced, the reckoning was within fourteen minutes of that by the timekeepers; the latter being more westerly, owing to the current. On the third day after, the difference was about twenty-four minutes, when the ship was 25 leagues S.W. from Scilly, in soundings of 70 fathoms. The ship, in lon. 8° 28′, had entered into the stream; and, its course being opposite to that of the *Hector*, it facilitated her progress, and carried her clear of the S.W. coast of Ireland.

"After this, in the course of fifty-one hours, the ship had set two whole degrees to the westward of her reckoning; and in the forty-five hours following, she had a farther set of twenty-three minutes; so that, in four days only, she had been carried by the current no less than 2 degrees and 23 minutes; and, since the gale began, 2° 32′ of lon., or 93 nautic miles.

"It consequently appears, that the *Atlas* experienced a westerly current, from about 24 leagues W.S.W. of Scilly, to near 4 degrees of longitude West of the meridian of Cape Clear, where its effect was imperceptible. It may, therefore, be inferred, that the stream goes off to the N.W. in the parallel of 51°; between lon. 14° and 15°, and the S.W. coast of Ireland.*

"No northern set is indicated in the journal of the *Atlas*. This would have been remarkable, had the weather permitted nice attention to the reckoning; but it is to be remarked, that observations on the latitude were not regularly made; and besides, that the great distance of 36 miles was allowed for only twenty hours' drift to the N.W., when the ship was lying-to.

"From the nature of this current it must be obvious that its velocity will always be proportionate with the strength and direction of the wind, by which its direction will also be regulated, and that the middle of the stream will preserve its original course in a greater degree than its borders. The direction of this appears to be N.W. by W., the eastern border more North; and the western more West; so that the northern current is stronger close to the West of Scilly than more to the westward.

"From the foregoing observations may be deduced the following inferences:—

"1st. That ships, which cross the current obliquely, steering a true E. by S. course, or more southerly, will continue longer in it, and be more affected by it, than those which steer more directly across it. In crossing it with light winds, the effect will be the same. Allowance must be made for the more northerly direction of the eastern edge of the current.

2nd. That, after a continuance of westerly gales, even should a good observation of latitude be made, it would be imprudent to run eastward, from the Atlantic, during a long night. For a ship might remain in the current so long as to be drifted from a parallel, deemed a very safe one, to that of the Rocks of Scilly. It is, therefore, recommended, that vessels, at such times, should keep, at the highest, 48° 45′, because in 49° 30′ the whole effect of the current may be experienced in the worst situation. But from the current in 48° 45′, a southerly wind will set the ship into the Channel. In time of peace, coming from the Atlantic, it would be still better to make Ushant.

"3rd. That ships, bound to the westward, from the Channel, with a south-westerly wind, so that it may appear indifferent which tack they go on, should prefer the *larboard* tack, as they will then have the benefit of the current."

In a Supplementary Paper *on the* Effects *of* Westerly Winds *in* raising *the* Level *of the* English Channel, *dated 22nd June*, 1809, *Major Rennell has stated:*—

"In the *Observations on a Current that often prevails to the Westward of Scilly*, which I had the honour to lay before the Royal Society many years ago, I slightly mentioned, as connected with the same subject, the effects of strong westerly winds, in *raising* the

* Captain J. W. Monteath, in the ship *Fame*, Sept., 1817, in lat. 52°, lon. 20° to 13°, experienced a current (which he allowed for and found correct) setting from W.N.W. to N.W., at the rate of from half to three-quarters of a mile an hour. The first part of this course, it may be observed, was on the parallel traversed by the *Atlas*, and commenced more than 4 degrees to the westward of the true course of that ship.

Added to this, that after a long prevalence of westerly winds across the Atlantic, and in running for Cape Clear, from lat. 50° and lon. 17°, when nearly on the parallel of the Cape, Captain Charles Hare, in the ship *Waterloo*, 11th Sept., 1821, found by chronometer, &c., that a current had set the ship 54 miles W. by N. in the twenty-four hours, preceding the noon of that day.—Ed.

level of the British Channel; and the escape of the superincumbent waters, through the Strait of Dover, into the *then* lower level of the North Sea.

"The recent loss of the *Britannia*, East India ship, Captain Birch, on the Goodwin Sands, has impressed this fact more strongly on my mind; as I have no doubt that her loss was occasioned by a current, produced by the running off of the accumulated waters; a violent gale from the westward then prevailing. The circumstances under which she was lost were generally these:—

"In January last she sailed from the anchorage between Dover and the South Foreland (on her way to Portsmouth), and was soon after assailed by a violent gale between the West and S.W. The thick weather preventing a view of the *lights*, the pilot was left entirely to the reckoning and the lead; and when it was concluded that the ship was quite clear of the Goodwin, she struck on the north-eastern extremity of the southernmost of those sands; and this difference between the reckoning (after due allowance being made for the tides) and the actual position I conclude was owing to the northerly stream of current, which caught the ship, when she *drifted* to the *back* or *eastern side* of the Goodwin.

"The fact of the high level of the Channel, during strong winds, between the West and S.W., cannot be doubted; because the increased height of the tides in the southern ports, at such times, is obvious to every discerning eye. Indeed, the form of the upper part of the Channel, in particular, is such as to receive and retain, for a time, the principal part of the water forced in, as may be seen by the Chart; and as a part of this water is continually escaping by the Strait of Dover, it will produce a current, which must greatly disturb the reckonings of such ships as navigate the Strait, when thick weather prevents the land, or the lights of the Forelands and the North Goodwin, from being seen.

"I observe, in a new publication of Messrs. Laurie and Whittle, entitled *Sailing Directions, &c., of the English Channel*, that, throughout the channel, it is admitted by the experienced persons whom they quote, that strong S.W. winds 'cause the flood tide to run an hour, or more, longer than at common times:' or, in other words, that a *current overcomes the ebb tide a full hour;* not to mention how much it may accelerate the one, and retard the other, during the remainder of the time.*

"It is evident that the direction of the current under consideration will be influenced by the form and position of the opposite shores at the entrance of the strait; and, as these are materially different, so must the direction of the stream be within the influence of each side respectively. For instance, on the English side, the current, having taken the direction of the shore between *Dungeness* and the *South Foreland*, will *set* generally to the N.E., through *that* side of the strait.—(See the Chart.) But, on the French side, circumstances must be very different; for the shore of *Boulogne*, trending almost due North, will give the current a like direction, since it cannot turn sharp round the point of *Grisnez*, to the north-eastward, but must preserve a great proportion of its northerly course, until it mixes with the waters of the North Sea; and it may be remarked, that the *Britannia*, when driven to the eastward of the Goodwin, would fall into this very line of current.

"There is another circumstance to be taken into the account, which is, that the *shore of Boulogne*, presenting a direct obstacle to the water impelled by the westerly winds, will occasion a higher level of the sea there than elsewhere; and, of course, a stronger line of the current toward the Goodwin.—(See the Chart.)

"It must, therefore, be inferred, that a ship passing the Strait of Dover, at the back of the Goodwin Sands, during the prevalence of strong West or S.W. winds, will be carried many miles to the northward of her reckoning; and, if compelled to depend on it, may be subject to great hazard, from the Goodwin.

"It will be understood, of course, that although the stream of current, alone, has been considered here (in order to simplify the subject), yet that, in the application of these remarks, the regular tides must also be taken into the account. But, from my ignorance of their detail, I can say no more than that I conceive the great body of the tide from the Channel must be subject to much the same laws as the current itself. The opposite tide will, doubtless, occasion various inflections of the current, as it blends itself with it; or may absolutely suspend it: and the subject can never be perfectly understood,

* It is also asserted that, in the mouth of the Channel, the extraordinary rise of tide in stormy weather is 10 feet; that is, in common springs 20, and in storms 30, feet.

without a particular attention to the velocity and direction of the tides in moderate weather, to serve as a good ground work." *

FURTHER OBSERVATIONS ON RENNELL'S CURRENT.

After the publication of the first paper on the current of the Channel, and the supplementary paper immediately preceding, Major Rennell published some further important observations upon it, which were read before the Royal Society, April 13, 1815, and from which we have the following extracts:—

"During the interval of twenty-one years, since the Society did me the honour to receive my *Observations on the Current to the Westward of Scilly*, more facts, relating to that current, have been collected, as well as observations on its effects, in different parts of its course, between Cape Finisterre and Scilly; the whole tending to a confirmation of the general system set forth in 1793; and, in one instance, affording perhaps a clearer proof of the strength of the stream, in respect of its *northerly* direction, than any of those adduced on the former occasion.

"In pursuing the detail of these facts and observations, I shall begin in the neighbourhood of Cape Finisterre, and proceed with the course of the current, along the Bay of Biscay; and thence across the mouth of the English Channel to Scilly, and the entrance of St. George's Channel.

"The first three facts regard the current from the open sea, setting into the South side of the Bay of Biscay, and along the North coast of Spain; which current has been supposed in the former paper to be occasioned by the prevalent westerly winds, which force the water near the shore *into the bay*, and along the southern coast of it. The water so displaced would be followed, of course, by the adjacent water *behind* it, in the open sea; and so on successively, to a certain extent. This cause must surely be referred to, as the origin of the Scilly Current.

"I. The first case is that of the *Earl Cornwallis*, East India ship. The circumstance occurred on her outward passage; she was well provided with timekeepers, as most of the India ships are.

"On the 12th of March, 1791, between the parallels of 43° and 44°, and at 3° 45′ of longitude West of Cape Finisterre (about 53 leagues), this ship experienced an easterly current, equal to 26 marine miles. Her position being directly opposite to the line of the southern coast of the Bay of Biscay, it is a fair conclusion, that the current was occasioned by the cause above mentioned, or, as seamen call it, the *indraught* of the bay; which, it appears, extends to at least 53 leagues from the shore. And as the rate, in this place, exceeds one mile per hour, it may be supposed that the effect extends to a still greater distance.

"It may here be remarked that the same ship, in coming out of the *chops* of the Channel a few days before, was *set* 24 miles to the westward, 15 to the northward, in the course of twenty-four hours; that is, 38 miles, in a direction of N.W. by W. This may be supposed to be the same stream of current in its course from the *bay* toward Scilly.

"II. The second fact is that of the *drift of a bottle*, which was thrown out of a Danish ship (I believe sent on discovery), since the publication of the former paper.

"The bottle was thrown out in lat. 44½°, lon. 12° West from Greenwich, that is, about 48 miles to the N.E. of the *Cornwallis's* station, at the time that she began to feel the current, on the 11th of March. It was taken up by a sentinel on duty, near Cape Ortegal, and, as was supposed, at the moment of its driving into the surf. If this was really the fact, the bottle, according to the date of the letter contained in it, must have been carried, at the rate of half a mile per hour, in the direction of about E. by S. ½ S.: the distance was about 64 leagues.

"The report of this circumstance was transmitted, by the French Consul at Corunna, to the Academy of Sciences at Paris.

"It may be observed that the drift of the bottle was much to the *South* of East,

* Messrs. Laurie and Whittle's publication allows the tide in this quarter a velocity of 1½ miles per hour at the springs; half a mile at the neaps. The *Britannia's* accident happened at *dead neaps*.

whereas that of the *Cornwallis* was East; that is, both pointed toward Cape Ortegal or its vicinity; as if the main stream of the current was concentrated there.*

"With respect to the velocity of the current in the present case, all, of course, depends on the time of the arrival of the bottle at the shore. It might have been thrown up long before it was seen, and washed off again by the tide, or surge, of the sea. The *direction*, the most important point, cannot be questioned.

"III. The third fact is very simple, and perfectly conclusive. Off Cape Ortegal, at a considerable offing, Admiral Knight found the current, at the rate of one mile per hour, setting to the E.S.E.; that is, nearly *along shore.*

"The reader will immediately perceive that these three facts converge, as it were, to one point; that is, in the proof that the waters of the Atlantic flow into the Bay of Biscay, along the North coast of Spain.

"It would seem that the north-westerly current, by Scilly, did not, at least in many cases, balance the easterly current round Cape Ortegal and the land of Finisterre.† The loss of his Majesty's frigate *Apollo*, with most of her convoy, may surely be attributed to the operation of this current. Captain (afterwards Commissioner) Wallace assured me, that after having made, as he supposed, ample allowance for clearing Finisterre, yet, in the night, he had a very narrow escape from shipwreck. Very many others have been brought into the same kind of danger: so that the land of Finisterre, were it not discernible at a considerable distance, and its offing clear of rocks and shallows, and, moreover, situated in a finer climate, would prove a kind of Scilly to mariners.

"I have not been able to obtain any proofs, on record, concerning the course of the current *round* the Bay of Biscay. I formerly collected some information from a French commander respecting it. He said, that the setting of the current along the coast of France, to the North and N.W., was a fact well understood; and even acted on by many in the choice of the *tack*, on which the current gave the greatest advantage, with dead winds.‡

"One circumstance, and that a very striking one, in respect to this particular, is that the soundings in the Bay of Biscay show little or no *muddy bottom* to the *southward* of the *Gironde* River; but everywhere to the *northward.* This seems to show that the mud of the *Gironde*, *Charente*, *Loire*, &c., &c., is all carried to the northward; and by what cause but a northerly current? Had the motion of the sea been variable, the mud would surely have been distributed to the South, as well as to the North, of the mouth of the Gironde. The alluvial *embouchures* of the rivers in general here, and the positions of the banks formed by them, in the sea, point to the North or N.W.; apparently the effect of the same sea-current.§

* It is observed that in the mouth of the Strait of Gibraltar, between Cape St. Vincent and Cape Cantin, the currents point in all directions, between S.E. and N.E. toward the entrance of the strait, which may be considered as the pipe of a funnel.

† Nor, admitting an equal rate, in both places, could it well be. For the current enters the Bay of Biscay, in an *East* direction, but goes off from it *N.W.*: so that, if a ship was carried 50 miles to the N.W. from Ushant, she would only have made about 35 westing; but, in the other case, she would be carried the *whole* 50 eastward, toward the Bay and Cape *Finisterre.*

‡ After the above was written, the author received the following important communication from Captain Wm. King, R.N.

Returning from India, a passenger, in February, 1797, in a merchant ship, he was captured by a French privateer. Intending to take the Port of Passage, in Spain, which is known to be near to Bayonne, in the very bight of the Bay of Biscay, she had arrived to within 4 miles of the entrance, when nightfall and the want of a pilot compelled her to stand off shore; a most violent gale of wind came on, blowing right on the shore, and which, blowing all their sails away, left them no hope of escape from shipwreck. They thus spent a miserable night, expecting every moment to be their last, and wondering at their prolonged existence; but, when daybreak appeared, they found themselves so far off shore, to the N.W., that it was hardly visible from the deck. Captain King remarks that the N.W. (or northerly) current must have been very strong, in order to have counterbalanced so great a drift; and to this he attributed their safety.

§ From a view of the Chart of Soundings between Spain and Ireland, one might be led to suppose that the deep water and steep shore along the North coast of Spain had been *partly* occasioned by the water driven in from the Atlantic, in westerly storms, along that coast; and which had gradually worn away the matter *there*, and deposited it on the bank which extends from Bayonne to the westward of Ireland. For the bank seems to expand, as it goes north-

"IV. In continuation of this current along the Bay of Biscay, I shall next mention that Captain (afterward Admiral) John Payne assured me, that, being in H.M.S. *Russell*, in a severe gale of wind at S.W., and with the ledge of rocks called the *Saintes*, not far to leeward, he was under apprehensions for the safety of the ship during the whole night, but, to his surprise, found himself carried clear of the danger by a current, which set the ship, in all, about 70 miles to the N.W.

"V. The flowing of the tides, on the West of Scilly, cannot well be accounted for, on any other supposition, than that the flood is prolonged by a southerly current. The flood tide is known to run nine hours to the northward; but the ebb, in the opposite direction, only three hours. This particular had not come to my knowledge when the paper of 1793 was written.

"VI. But the most satisfactory proof, not only of the *existence* of a *northerly* current athwart the mouths of the British and Irish Channels, but also of its *velocity* (at least during certain intervals), is a statement in a book published in 1733, entitled 'Joshua Kelly's Treatise of Navigation' (in two volumes octavo). This case is the more satisfactory, as it happened in a *dead calm* of forty-eight hours' continuance; so that all uncertainty regarding the accuracy of a *sea-reckoning*, allowances for *leeway*, *drift*, &c., is precluded; since the changes of position that took place could only have been effected by the motion of the sea, either in the nature of a *current* or of a *tide;* and this latter must be placed out of the question, since the interval of time included no less a space than that in which four *fluxes*, and as many *refluxes*, have their periods: so that they may well be supposed to balance each other.

"'It has been observed,' says Mr. Kelly,* 'by an experienced commander, who used the West India voyages for many years, from England (in his return from one of these), that, in about the latitude of 48° 30′, open with our British Channel, having a good observation (of latitude) at the same time, it proving calm and smooth water, insomuch that he handed his sails, and so lay forty-eight hours. The first twenty-four hours, at noon, he observed the latitude again, with clear weather, and found by the same that he had *drove to the northward* 20 *miles:* which made him distrust his former observation, though his mate agreed with him; because the ship had not gone, to his knowledge, one mile; and, upon review, he found that he was not mistaken. The next twenty-four hours, being still calm, he had again another good observation, and then found himself about 26 miles to the northward of his last observation; which confirmed him that he was right the day before; and that this must be imputed to a strong northern indraught, or current, there. For when you come near the soundings, and till you bring Ushant South of you, on the E.S.E. course,† *you will hardly hold your latitude;* and the general course is E.N.E. or E. by N.; if but a small matter to the southward of latitude 49°. And he says, that would have been my course, if we had not met this opportunity of discovering this strong indraught: and, from want of observation [*i.e.*, if he had not known the latitude], must have run up St. George's Channel, or the North Channel, as many have, and still do, from want of the same [information].

"'After his last observation, the wind sprang up; and, making allowance for the said indraught [*i.e.*, in his future course], the next day he was brought into soundings; and the following day he was brought in sight of the *Lizard*, by steering to the southward of the East.'‡

"It will naturally occur to the reader, that although this case gives the *northing only*, yet that, in respect to the main question, which is, the danger of shipwreck on Scilly, or of being carried into the Bristol Channel, it is sufficient to prove a conviction of the necessity of attending closely to the ship's course, when on the point of entering the English Channel, after, or during, a course of strong westerly or S.W. winds. But it would, doubtless, have been more satisfactory, had the *direction* of the stream been known. Had that been *north-westerly*, as I have before supposed, the rate of velocity must have been more than 1¼ miles per hour; or approaching to 1½ miles (the northing

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ward, in like manner as the current; and the water is shallower than might be expected, in proportion to the depths farther in.

* Vol. i. p. 434.

† These are *compass* bearings. The magnetic variation, at that time, being about a point and a half westerly, these will be respectively E. ½ S., N.E. ½ E., and E.N.E. ½ N., true.

‡ Meaning, no doubt, the E.S.E. course, by compass, as above, or true E. ½ S.

being 23 at a mean in the twenty-four hours); whilst that in the *Atlas* East Indiaman, recorded in a former paper, was about one mile per hour during four days consecutively.

"The statement in Mr. Kelly's book, which is, indeed, altogether more brief than could be wished, is also defective through the want of the distance sailed, from the place of the last observation for the latitude, to that from whence they saw the Lizard Point. They had their first soundings the day after that observation; and on the following day they saw the Lizard. His course appears to have been regulated with a view of preserving, nearly, his parallel of 49° 16′; to which he had been carried by the current. It is not likely that he sounded to any great depth; perhaps 70 fathoms; which in that parallel might have been about 20 leagues S.W. from Scilly: and it does not appear that he considered himself in soundings when the calm began; which, however, it is probable he was, although in deep water.* Accordingly one may conceive that his position, *at the end of the calm*, might have been about the meridian of Cape Clear, or somewhat to the eastward of it. It must be recollected, that, in running toward the Channel, after the calm, he had still to encounter the same adverse current; and that, possibly, to within 30 or 40 miles of his seeing the Lizard.

"But whether his position, during the time that he was under the influence of the current, be a degree or more less to the eastward, the fact bears the same on the main question; since a ship, in crossing the stream, wheresoever it may be situated, must have been carried out of her reckoning, and thereby placed in danger; in the event of thick weather happening subsequently, and preventing their setting themselves right by an observation of latitude.

"His idea of the eastern edge of the stream is worth remarking; as it approaches, in a general view, to the truth. It was, that in *about* the parallel of 40°, it approached to the meridian of Ushant. And with respect to the *direction* of the stream, as he calls it a *northern indraught*, he certainly concluded that it ran to the northward, into the St. George's or Irish Channel, brushing the West side of Ushant and the Land's End. And the effect of the current on his ship was, no doubt, such as to warrant that belief, with those whose knowledge of the subject was confined to the mere effect of setting them to the northward of Scilly and into the mouth of the Bristol Channel.

"The information contained in this statement does not even terminate in the mere facts of the existence and force of the current. The commander of the West India ship is said to have made *many voyages* to and from that quarter; and his narrative shows him to have been *an observant man*. Yet *he* was ignorant of the existence of such a current, until the case occurred which has been just stated. This then alone may serve to show very satisfactorily, that the current does not exist in strength but at certain invervals; and therefore operates in a more dangerous, because a treacherous, manner.

"Had it constantly prevailed, like that round the Cape of Good Hope, &c., it could not have escaped detection; and, in consequence, few or no evils would have ensued; but these effects being only felt casually, they were considered as mere contingencies, arising from wind and weather, as in other parts of the sea; and not as resulting from a fixed cause, always operating, although in very different degrees; since no person at that time had collected the different cases, with a view to examine and compare them. Some, indeed, referred it to the indraught of the Bristol Channel; without considering that, if such a power existed at all, it was difficult to conceive how it could be suspended, and why it should not operate at all times.

"Our navigators, in earlier times, appear to have entered the English Channel on a more southerly parallel than they have done in latter times. For, although they might have been ignorant of the real cause of their disturbance in their course, yet many of them believed that there was an *indraught*, as they called it, into the St. George's Channel; so that one effect of the current, that is, the *northern set*, had not passed unobserved, although the *cause* was not understood; nor, of course, could it be known when to expect it. But I have also heard it remarked by sea-officers as long ago as I can remember, that 'it was unaccountable what should occasion their *running down so much distance*, in coming in with the land from the westward.' I never heard, however, that there was any suspicion of a current setting westward.

"The idea of a northern *indraught* into St. George's Channel (but which applies equally to the current West of Scilly) is clearly set forth in a publication by Captain

* Perhaps 30 or 35 leagues to the West of *Ushant*, and in about 100 fathoms.

Joseph Mead, in 1757; but which came to my knowledge only very lately, by the favour of Mr. Purdy. Captain Mead first relates the case of the ship *Hope*, of Liverpool, bound from the coast of Guinea to that port, in November, 1735. (Preface, p. iii.)

"'Having had a good observation, by which they found they had the Irish Channel open, the wind continued to blow strong from between the South and West, but mostly from the former. Having no other observation [of latitude] for six days, in which time they carried sail constantly, they by reckoning expected to fall in with Cape Clear: but in the following night they fell in with the *Blasquets*.' These islands and rocks are situated in lat. 52° 10′, or about 48 miles to the North, and one degree of longitude to the westward of Cape Clear.

"Again (page 10) he says, that the Bristol merchant-ships, which fall in with Cape Clear, on their homeward passage [from the West Indies, &c.], shape their course from thence, with a large wind, to the high land near *Padstow;* which is the land they choose to make to lead them to the entrance of the Bristol Channel. That, in estimating this course, they allowed 4 or 5 degrees in the bearing, to compensate for the indraught into St. George's Channel. This angle would give about 13 or 14 nautic miles; and is probably what they found by experience to be the general amount of the *northern set.**

"He goes on to say that, in like manner, the safety of ships, after they come into soundings, until they reach Scilly, depended on their making *no less allowance* than the Bristol men do in the other Channel. For, says he, 'experience informs me that, from the commencement of soundings, in lat. 49° 30′ N., to the length of Scilly, in *fair weather*, I had found the northern indraught to be 6 or 8 miles in the twenty-four hours.'"

Here, then, the fact of the *northern set* is a second time recognised; though without any suspicion, any more than before, of there being a *westerly set* also.

Here it may be proper to state, what appears to me to be a very important fact; although perhaps not connected with the current in question, but materially affecting the safety of the navigation between the English Channel and Dublin. It was communicated to the author by Captain Evans, a gentleman who superintends the harbour-works at Holyhead, and who has had much experience in the navigation of the Irish Sea.

"All navigators (says he) in their voyage from the Land's End to Dublin, find themselves more or less carried to the eastward, while running up St. George's Channel; which is the cause of so many vessels finding themselves in Cardigan Bay; where in tempestuous weather, and westerly winds, many have been lost. And this he justly supposes to be occasioned by a current setting to the north-eastward."†

* Although they might not have known at that day the *true* latitude of Cape Clear, yet it may reasonably be supposed that they knew the quantity of the *difference of latitude* between Cape Clear and the high land of Padstow; as it was so necessary to their purpose, and so easy to be obtained.

† We have assumed the liberty of giving a very long extract, with regard to the current, as it sets athwart the Channel; but it is requisite to notice, that the venerable author, after establishing this fact, has given some further remarks on the currents, in general, about the British Isles; all of which, it is almost superfluous to state, are worthy of the mariner's attention.

From subsequent communications, it has been shown that the water sets into the Bay of Biscay from the N.W. as well as the West, at times as high as the parallel of 47°; and it is supposed that a *whirl* is sometimes formed by the outer part of the water; that the bay discharges to the N.W., turning to the West, and round the South and S.E., while the inner part shoots to the N.W. and W.N.W. Hence it may be concluded that, when the volume of water received, and, of course, the velocity, is very great, the whirl to the left or West is farther removed to the N.W., and the contrary.

Of this current Captain Livingston says:—"I have seen, in a late magazine, some one alleging that Rennell's Current, athwart the Channel, is imaginary. I know the contrary from experience, and perfectly remember, that in 1813, while master of the *Lark* sloop, I was set one day twenty-four minutes North of dead reckoning, equal to one mile an hour, but can say nothing as to the westing. On coming lately from Bordeaux, 1819, we were set by it seventeen minutes North in twenty-four hours; but, as a passenger, I had, at this time, no opportunity of keeping a reckoning."

On the 13th July, 1826, the ship *Carshalton Park*, Captain J. S. Park, entered upon the Bank of Soundings on the parallel of 49°, and between the meridians of 11° and 9° W. "*Rennell's Current*" was then found to be setting with dangerous strength. The ship crossed it rapidly; running all the time at the rate of 7 knots, but was swept 14 or 15 miles to the

FURTHER DEMONSTRATION.—To the preceding development, by Major Rennell, we may with propriety add a notice of the loss of *La Jeune Emma*, of Cherbourg, commanded by Chacelot de Chatillon, in the night of November 28, 1828; an extraordinary and memorable instance of the operation of the current. This vessel, of about 400 tons, from Martinique, was bound to Havre de Grace, with colonial produce. She had, in her passage, encountered several severe gales (we presume from the S.W.) and had shipped two heavy seas. On advancing toward the English Channel, the weather was hazy, and thus continued for *several days*, so that no observation could be taken, and the reckoning consequently became erroneous. At length a lighthouse was seen, supposed by the captain to be that of *Ushant*, and a course was shaped accordingly; but this unhappily brought the vessel to the *Cefn Sidan Sands*, within the *Bar of Caermarthen Harbour*, and the next day became a total wreck. The captain and passengers were drowned, and from a crew of nineteen only six were saved.

The narrative states that there is not, perhaps, a beach of this kingdom, where there is a more furious sea running, during the prevalence of south-westerly winds, than Cefn Sidan Sands, nor any which has proved more eminently disastrous to those who have been so unfortunate as to have been driven on them.

The event proved that the lighthouse, which had previously been supposed to be that of *Ushant*, on the French coast, was really that of *Lundy Island*, in the Bristol Channel! The latitude of Lundy Lighthouse is 51° 10′; that of Ushant 48° 28′. The difference of latitude between the two is, therefore, 2° 42′, or 162 miles; a difference surely too great to have been effected by merely ordinary circumstances, but which may, in the absence of positive information, be assumed as a presumptive proof of the operation and strength of *Rennell's Current*. This case is not cited as exhibiting any circumstances which proper precaution could not have avoided, but is here quoted from a multitude of others where the error is on the same side, and all of which tend to confirm the previous remarks.

EXPERIMENTS ON THE CURRENT.

INSET into the BAY of BISCAY.—A bottle from the *Lady Louisa*, bound to St. Michael's, in lat. 45°, lon. 13° 45′, 2nd February, 1830, found on the coast of Lit, in the province of Bayonne, 14th of October, in the same year.

CHANNEL SOUNDINGS into the BAY.—Bottle from the brig *Hope*, from Havannah, 31st March, 1838, in lat. 50° 10′, lon. 9° 43′; wind *strong from the eastward* for three days; found on the 1st of June, 1838, on the coast of Rochefort; having probably been first impelled to the S.W. by the ebb tide and prevalent wind, and thence following the general inset to the South and East.

QUERY.—"Why should the sea be higher, or more dangerous, in the Bay of Biscay than it is in the middle of the Atlantic or elsewhere? Is it really so? are questions often asked.

"I believe that there is a shorter, higher, and consequently worse sea, in and near the Bay of Biscay, than is often found in other places, and attribute it to the effect of immense Atlantic waves, rolling into a deep bight, where they close upon each other, and receive vibratory undulations from each shore; augmented, perhaps, by the peculiar formation of the bottom of that bay, the variation in depth, and the effects of currents, which, when running over uneven ground, or against the wind, alone cause a heavy swell; a striking exemplification of which may be seen on the Bank of Agulhas, near the Cape of Good Hope."—*Captain FitzRoy*, vol. ii. p. 45.

From CHANNEL SOUNDINGS to the WEST OF SCOTLAND.—A bottle thrown from the ship *Duke of Marlborough*, Captain Jeffery, by Mr. George Thom, near the Sole Bank, in lat. 43° 38′, lon. 9° W.; found on the shore of Carsaig, near the middle of the South

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N.W. by W. It had been previously ascertained that no current existed, nor was any found eastward of 9° W. The wind was between S.W. and N.W., flying about in squalls.

At nine a.m., on the 14th, Captain Park made the Lizard, bearing N.E., and had the satisfaction to find his chronometer perfectly correct.

INSET INTO THE BAY.—Captain George Cheveley, June 1830. Lat. 52° to 47°, lon. 12°; current E.S.E. half a mile.

Lat. 47° to 44,° lon. 12° to 11°; current E.S.E. three-quarters of a mile.

side of the Island Mull, 14th of April, 1821, and made known by Mr. Hector Maclean. At the time this bottle was thrown into the sea, the ship was on its passage to London from the Cape of Good Hope, and an allowance was made for current to the N.W. of 12 miles to the twenty-four hours. From the spot in which it was dropped, it seems unquestionable that the bottle was carried by the current to the West and North of Ireland, and thence between Ila and Mull, to the place in which it was found. It has, therefore, well answered Mr. Thom's purpose of "*confirming Rennell's Current.*"

Bay of Biscay to the North of Scotland.—A bottle, enclosing a song composed on board, from the *Great Western* steamer, on her voyage to New York, at midnight of September 10, 1838, in lat. 48° 3′ N., lon. 9° 52′ W.; picked up by Captain Thornton, of the *Ceres*, in passing through the Pentland Frith, on the 16th of the same month. It must, therefore, have drifted to the north-westward and northward, off the western coast of Ireland, and thence to the N.E. and East, by the general drift from the Greenland Seas.

St. George's Channel.—A bottle from the ship *Osprey*, of Glasgow, Alexander M'Gill, master, which sailed from Greenock on the 20th of February, 1820, on a trading voyage around the world. This bottle (No. 310) was thrown into the sea 1st March, 1822, on the ship's return from Calcutta, in lat. 49° 54′ N., and lon. 12° 20′ W. It was found on the shore, upon the South side of Milford Haven, on the 6th of the following month, April; and the notice was thence transmitted to the Admiralty.

Easterly Current to Bristol Channel.—A bottle from the brig *Albert*, R. L. Robertson, master, lat. 47° 20′ N., lon. 22° W., 24th January, 1822, on the passage from Virginia to England, the wind then about W.N.W., and had so prevailed for two or three days. Found in Rockam Bay, about 4 miles West from Ilfracombe, 29th July, 1822, and attested by the agents to Lloyd's.

Bay of Biscay, North Side.—A bottle from the ship *Graham Moore*, 6th of July, 1821, in lat. 47° 47′ N., lon. 7° 51′ W.; found, 15th of September, 1821, on the coast of St. Jean de Mont, arrondissement of Sables d'Olonne, department of La Vendée; and made known by the '*Journal de Paris*.' This bottle was impelled in an E.S.E. direction, the *north-westerly* current not then prevailing, and was within the influence of the *tide*.

By Captain Livingston's Journal, 28th November, 1820, "It appears that in twenty-four hours, ending at noon of yesterday (on the passage from Gibraltar), we made about 15 miles *North* by current; and in twenty-four hours, ending at noon this day, about 13 North; and in the two days rather more than 20′ E. Therefore about N. 40½′ E. 37 miles in the forty-eight hours."

Inset to, and Outset from, the Bay of Biscay.—A bottle from the *Iris*, Captain Skinner, in lat. 47°, lon. 21°, 9th September, 1802; found at the Isle of Skye (lat. 57° 15′, lon. 6° 20′), 22nd February, 1803. (Probably carried into the Bay on an eastern direction, subsequently northward by Rennell's Current, and thence by the eastern drift to Scotland.)

The ship *Jessie*, Bevan, master, left London for the Bahamas about the 13th of November, 1833. She was struck by lightning and abandoned by her crew, in lat. 45°, lon. 14°, and on the 5th February, 1834, drove on the *Isle Groix*, near L'Orient, and was immediately dashed to pieces.

Inset; Bay of Biscay.—A bottle from the *Carshalton Park*, Lieut. J. Steele Park, 27th July, 1827, in lat. 48° 39′, lon. 10° 21′; taken up, 21st December, 1827, on the shore of Pembron Road, near the Loire, in the Bay of Biscay, lat. 47° 19′, lon. 2° 30′ W.

A bottle from H.M.S. *Arrow*, in lat. 48° 30′, lon. 9° 25′, 14th July, 1838; wind from S.W. for five days, a fresh gale, and then S.W. Another bottle from the *Maitland*, transport, in lat. 49° 5′, lon. 18° 19′, 10th March, 1838. Both found, on the 25th of February, 1839, on the shore of Arcachon, in the bay, lat. about 44° 40′ N.

A metal cylinder, cast from H.M.S. *Chanticleer*, Captain H. T. Austin, 3rd of May, 1831, in lat. 44° 38½′, lon. 11° 4′ W.; found near Vivero, on the North coast of Spain, 12th of September following, at about 150 miles from the spot where it was dropped into the sea.

A bottle from the bark *Mary*, of London, Abyah Locke, master, 12th of April, 1832, in lat. 48° 30′, lon. 16° 56′; found on the coast of Jart, lat. 36° 25′, 4th March, 1833.

Another bottle, from the same vessel, 17th April, 1832, in lat. 46° 15′, lon. 17° 58′; found near Cape Feret, 44° 38′, 21st February, 1833.

A bottle thrown over from the *Wellington*, August 23rd, 1837, in lat. 45° 10′ N., lon. 12° 58′ W.; thrown on the South coast of the Isle of Ré, probably about the end of February, 1838; found March 2nd, 1838.

TIDE WATER on SOUNDINGS.—A bottle from the bark *Wallace*, of Alloa, bound to Van Diemen's Land, 12th of April, 1835, in lat. 52° 13′, lon. 15°. Picked up at 5 miles from Ushant, 21st of August, 1835.

A bottle from the *Kent*, troop-ship, in lat. 50° 20′, lon. 19° 0′ W., August 19th, 1836. Picked up near Cape Blancnez, a few miles from Boulogne, December 20th, in the same year.

BAY OF BISCAY, SOUTH SIDE.—A bottle from the schooner *Morning Star*, of Liverpool, Captain Andrew Livingston, 7th of October, 1821, lat. 42° 45′ 39″ N., lon. 13° 3′ 21″ W. Found about 29 miles to the northward of Bayonne, in the arrondissement de Dux, lat. 43° 58′ N., lon. 1° 20′ W., and made known by the direction of the Minister of the Marine and Colonies of France in the "*Moniteur*" of January 24, 1822. To his Excellency, and the Baron Seguier, consul-general of France in England, we are indebted for this information, and for the original document addressed by our friend to the editor of this work.

One of the most singular routes of the kind that we have met with was a bottle, covered with barnacles, picked up at the Mizen Head, on the S.W. of Ireland, October 19, 1837. Its enclosed note stated that it was dropped off Cape Horn, from the *Salem*, R. Crukers, master, of the United States, in lat. 53° 3′ S., and lon. 67° 5′ W., on the 24th of June, 1830.

NOTE.—*These bottle experiments are vague; they prove nothing as to the irregularities or the velocity of the current: it cannot be known how long the bottles may have lain on shore undiscovered; but still they show, when uniformly found to have set in nearly one direction, the* general *tendency of the drift or current, on the surface of the ocean; and have thus been very useful.*

The foregoing are the principal arguments and facts upon which the existence of the thwart-channel current is inferred. That there is some cause for the drifting of the various vessels, &c., in a northward and westward direction, there can be no doubt; nor can there be any doubt that the stream varies both in strength and in direction. Without inquiring into the sufficiency of the cause to produce these effects, or of the correctness of the views promulgated by Major Rennell, the foregoing remarks have been repeated, as originally given; and here we would add that they were formed long before any correct knowledge of the tides or of the tidal currents was acquired, and also that a very just estimate of the amount of derangement of the *regular tides*, or of the set of the current across the mouths of the English and St. George's Channels, is formed from his dissertations.

In the section on the TIDES, in the previous part of this work, it was stated that the tidal streams, in most parts, near and on the coasts, ran towards each point of the compass in rotation, or else the set performs only part of the circle and then retrogrades; and that they also vary in strength and velocity in different states of the tide.

Upon this system of the rotation of the tides, Captain *Martin White* has accounted for the current in question, and refers the phenomena entirely to the action of the tides: we therefore extract the following from his work:—*

"It appears that the English and Irish Channels resist the direct ingress of the flood tide, generally until about half-flood; the stream until that period running to the westward and south-westward; and that the tide of flood enters the Bay of Biscay in greater proportion from the westward than from the northward, as we should naturally expect it to do, the main body of the water being directed towards Bayonne, as towards the vertex of a triangle, varying, however, in its direction north-eastward and northward, as the water in the bay accumulates, and as the indraught in consequence decreases. Now the

* Remarks on the Winds, the Tides, and the Currents of the Ocean, with other Phenomena, by Captain Martin White, R.N.; Jersey, 1844, p. 73.

peculiar configuration of the shores which form the bay, added to the consideration that it possesses no outlet, and that it presents a direct obstacle to the easterly progress of the water, are more particularly adapted to receive any impression from the westward than the contracted mouths of the two channels will admit of; and as the superficial contents of the Bay of Biscay exceeds that of the English and Irish Channels both together by about one-fifth part, the quantity of water compressed into the former space must proportionably exceed the quantity received by the two latter, as well in weight as in altitude.

"The stream, therefore, will eventually set out from the bay with a much greater influence in a northerly direction than in a westerly one, as the same operations which conspire to augment the level in the southern parts of the bay, where there is *no* direct egress, will, from the known property of fluids, produce a corresponding discharge in that quarter where there *is*; and as the tide along the North coast of Spain has the advantage of two hours' elevation over that in the vicinity of Ushant and Scilly, the stream sets out then towards a lower level, in a north-westerly direction, in the nature of a tangential force, and crosses the mouths of the two channels with such energy, as to warp the streams in each out of their natural courses. This event takes place in the vicinity of Ushant and Scilly about one hour's flood, at which time it is nearly three hours' flood in the southern parts of the bay; and nearer Cape Clear, it takes place at four hours' ebb, which proves at once the joint operations of the tides in the English Channel and the Bay of Biscay. At half-flood, the stream in the bay and in the mouths of the two channels, as well as along the English, French, and Irish coasts, inclines generally to the north-eastward, and eventually to the south-eastward, revolving, for the most part, with the course of the sun, until, at length, the level in the two channels predominating over that in the offing, the bias is reversed, and the water commences its retreat westward and south-westward; and this event takes place, as was before observed, about the period of half-ebb."

Captain White then proceeds to consider what the effect of the various sets of the tide would be upon a vessel proceeding from lat. 51° 1½′ N., lon. 9° 7½′ W., to lat. 49° 2′ N., lon. 6° 46′ W. (or across the mouths of the two channels). "Then, by a due construction of the sets of the tide at and between these two positions, and comparing the sets with the periodical distances, it will become evident that the vessel, during her run from one position to the other, will experience seventeen hours' tide to the westward of North and South, and only seven to the eastward of those points, and that the hourly velocity of the former will exceed that of the latter in the averaged ratio of five to three; from which it will appear that she has not only to contend with the actual set, but also with the increased velocity.

"These considerations will fully account for the increased rapidity of the Seine and Four Passages, near Brest, as well as for that in the vicinity of the Crim and Bishop at Scilly, and for the excess of the north-eastern stream at Ushant above that of the south-western; the former, according to the authority of Captain Thomas Hurd (our late highly respected hydrographer), running seven hours, the latter only five. They will, moreover, establish the fact that the tide to the westward of Scilly runs *eight hours* to the *northward*, between E.N.E. and W.N.W., and *only three hours to the southward*, between E.S.E. and S.W. by S."*

Now this view of the case is precisely that entertained by Major Rennell in his paper of April, 1815, quoted on a former page, which we will again transcribe. "V. The flowing of the tides, on the West of Scilly, cannot be well accounted for, on any other supposition, than that *the flood is prolonged* by a southerly current. The flood tide is known to run nine hours to the northward; but the ebb, in the opposite direction, only three hours."

Captain White applying this principle to the case of the *Atlas* East India ship, which, laying-to for thirteen days in a south-westerly gale of wind, would consequently experience in that region an *excess of no less than one hundred and thirty hours' tide to the westward of North and South.* This is sufficient for the purpose, for it is evident that there is a northerly and westerly tendency of the sea athwart the mouths of the channels.

It is not the province of this work to enter into theories: and therefore whether this is the effect of the tides alone, or that the ebb tide overcomes and modifies the current only during three hours of its north-westerly course, must be left to other decision.

* Captain White's Remarks, &c., p. 78.

2. THE ARCTIC OR GREENLAND CURRENT, WITH EASTERLY AND S.E. DRIFT-CURRENTS TO THE COASTS OF EUROPE AND AFRICA.

Both the great easterly and westerly motions of the waters of the Atlantic may be traced to very remote causes. The *Equatorial Currents*, as hereafter shown, may be clearly traced from the Indian Ocean, and around the Cape of Good Hope, to the Brasilian Sea. Those of the *northern regions* may, in like manner, be traced from the Polar Seas, Hudson's Bay, and Davis Strait. The latter, in their progress, on the West, winding about the coast of Newfoundland, and toward the East, setting eastward and E.S.E., to the Bay of Biscay; more to the southward, along the coast of Portugal; and more to the northward, toward and along the Western Isles of Scotland, &c. In the summer, more constantly in these directions; in the winter, more variable and less southerly.

This scheme of a *general* predominance in the motion of the waters is grounded, not upon any questionable theory, but upon incontrovertible facts. The evidence of a powerful southerly current setting at times, if not always, between Iceland and Greenland, is shown in our MEMOIR, &c., ON THE NORTHERN OCEAN, pages 56 and 112: the currents from Hudson's and Davis Straits are also described in the same work, p. 61.*

For the origin of the currents which fall into Baffin's Bay and Davis Strait, Captain Dundas Cochrane adverts to the Polar Sea, which washes the northern coasts of North America. "Every expedition," says he, "which has been sent from this country up Baffin's Bay, Davis Strait, Hudson's Bay, as also that under Captain Franklin, has noticed the perpetual currents setting from the Polar Basin into Baffin's Bay; Captains Ross and Parry found them upon the first, as did the latter on the last two voyages, at the rate of 3 and 4 miles an hour. I believe there can be but little doubt that, from Hudson's Bay to Lancaster Sound, there is an endless variety of channels and straits which must form currents; and the more numerous and contracted those channels are, the greater the difficulty of stemming them. It is, indeed, miraculous how the ships have been so often saved from being dashed to pieces, crushed to atoms, or run down by icebergs, from thus sailing in opposition to the stream.

"Upon the other [the western] side of America we have the voyages of Cook (or more properly of Clerke), of Kotzebue; and, lastly, of the Russian expedition under Captain Vasillieff. Currents were found by these three navigators setting to the North, N.E., and E.N.E. The voyage of the latter is, however, more in point: the commander of that expedition told me, at Kamtschatka, that so strong was the E.N.E. current, after his fast-sailing sloop had got round [beyond] Icy Cape 30 miles, he was afraid to continue lest he should not be able to get back; considering, as Captain Vasillieff did, that it would be imprudent, if not dangerous, to winter upon the North coast of America, separated from his consort; the latter being employed in surveying the N.E. coast of Asia, &c.

"All authors, all judges, all persons who have made inquiries upon the subject, admit of a current setting from the Pacific into the Polar Sea (toward autumn at least), by way of Behring's Strait, as well as a current from the Polar Sea to the Atlantic Ocean, by way of Baffin's Bay.

"The currents observed by Captain Franklin, and strengthened by the drift-wood being *always* to the westward of the headlands, prove, beyond a doubt, that, in these regions, no western current ever takes place."†

* Impelled by currents from the North or N.E., during the spring of 1827, the North and East coasts of Iceland were visited by an extraordinary number of icebergs, which produced so much cold and drought, accompanied by furious gusts of wind, that vegetation was at a stand. By way of amends, the fishery, especially on the southern parts of the island, was exceedingly productive.

† Arguments in favour of an expedition for exploring the North Coast, commencing with Behring's Strait, by Captain John Dundas Cochrane, R.N.—*New Monthly Magazine*, 1st of May, 1824. These arguments have been strengthened by the general observations on the Winds and Currents of the Polar Sea, by Captain (now Sir John) Franklin and Dr. Richardson, made on the expedition of 1825-26-27; also by those of Captain (now Sir William Edward) Parry, in his attempt to reach the North Pole from the Sea of Spitzbergen; but it may be stated that the permanency of a northern current through Behring's Strait is by no means established.

These remarks satisfactorily illustrate the cause of the current which so powerfully sets to the southward from Hudson's Strait, &c., thence to the Strait of Belle-Isle and coast of Newfoundland. On the eastern coast of the latter, spreading over the ocean, it appears to come from the north-eastward; sometimes with a velocity of 2 miles an hour. Its strength, however, varies with the direction and force of the wind. Passing down the eastern coast of Newfoundland, it turns round Cape Race, and sets thence along the South coast of the island, until it meets with the St. Lawrence current, a little to the westward of Miquelon Island, as shown hereafter.

STRAIT OF BELLE-ISLE, &c.—It has been remarked, by Captain Bayfield, that a branch of this current, setting inward through the Strait of Belle-Isle to the Gulf of St. Lawrence, is confirmed by the presence of icebergs, which it transports into the gulf every summer, against the prevailing S.W. winds; frequently carrying them as far as Mecatina, and sometimes even to the vicinity of the East point of Anticosti. Its strength is very much increased by a prevalence of N.E. winds: at such times it runs at the rate of 2 knots, through the strait, and for 30 or 40 miles farther to the westward; diminishing gradually in force as it spreads out in the wider parts of the gulf. Usually, however, its rate is much less; and, at times, when S.W. winds prevail, it becomes very weak and imperceptible.

From the mouth of DAVIS STRAIT on the East, it has become clear, from various experiments, that the predominating current sets to the eastward. Of the bottles thrown into the sea from the ships commanded by Captains Ross and Parry, in 1818, one was found, dated 24th of May, on the Isle Bartragh, Killala Bay, Ireland; another, dated 29th of May, about 3 miles from Innishowen Head, near Urris, on the West of Ireland; another, dated 3rd of June, was found at Balnarald, North Uist, one of the Western Isles of Scotland. The times in which these were found, were June, July, and August, 1819; it is impossible to describe the course of these bottles, or how they were impelled by the winds; and such facts are recorded merely from the want of better data.

What may be the *general* direction of the predominating current from and about the North Cape of Europe, we cannot say; but we are certain, that it is very common for ships from England, outward bound, to be far astern of the reckoning; and that, in proceeding toward the White Sea, in the spring, they meet with great drifts of ice from that sea, as shown in our *Memoir, &c., of the Northern Ocean.* Immense icebergs were seen off the coast of Denmark, in January, 1820, supposed to be fragments of larger masses, rent from the North.

In introducing the experiments upon the set of the currents made by bottles, we would refer our readers to a very interesting Chart of the Atlantic, showing the effects which have resulted from a large number of these trials, which is given in the *Nautical Magazine* for Mar., 1843, and Nov., 1852. It is the work of Commander Becher, and exhibits, at one view, the *general tendency* of the set of the currents, and which, with the accompanying descriptions of these messengers, forms a very important chapter in the Hydrology of the North Atlantic. Although the conclusions to be arrived at from them may be somewhat desultory, yet they *must* serve to elicit the general laws which govern the motions of the ocean. As the examples which have been given in the former editions of this work are sufficient for the elucidation of the subjects they bear upon, we have not now multiplied instances, but again direct attention to a larger number and more comprehensive range of observations, as contained in that chart.

ICELAND TO THE FRITH OF CLYDE.—A bottle from the *Merioneth*, whale-fisher, R. Morris, master, 27th July, 1820, in lat. 62° 10′, and lon. 19° 30′. Found, on the 4th of September, 1820, by John Lamont, a fisherman of Bute, near the Cumrays. In the month of August, therefore, this bottle was carried by the current, in a south-easterly direction, to the North Channel of the Irish Sea; and thence, by the tide of flood, to the entrance of the Clyde.

GREENLAND TO TENERIFE.—A bottle from the ship *Hecla*, Captain Parry, 16th of June, 1819, in lat. 58° 13′ N., lon. 46° 55′ W. Found, on the S.E. shore of Tenerife, 29th of July, 1821, and the notice was transmitted to England by Messrs. Pasley, Little, and Co.

NORTHERN OCEAN TO THE CANARY ISLES.—A bottle from the *Camillus*, of Greenock, in the winter of 1830, about 130 leagues to the N.E. of Newfoundland. Picked up at the Grand Canary, 19th of April, 1832; and thus proving the vast extent of the drift-stream from the Arctic Seas.

HUDSON'S STRAIT TO IRELAND.—A bottle from H.M. ship *Fury*, Captain Parry, July, 1821, in lat. 62° 8′ N., and lon. 62° 27′ W. Found, 9th of March, 1822, on the shore of Irris, county of Donegal, Ireland, lat. 55° 15′, lon. 7° 28′; and thence transmitted to the Admiralty.

DAVIS STRAIT TO IRELAND.—A bottle from H.M. ship *Alexander*, Captain Parry, in lat. 62° 5′, lon. 54° W., 29th of May, 1818. Found off the N.W. part of Donegal, 15th of July, 1819.

DAVIS STRAIT TO SCOTLAND.—Another bottle from the *Alexander*, lat. 59° 8′, lon. 52° 19′, 27th of May, 1818. Found, 28th of July, 1819, near the Isle of Staffa.

DAVIS STRAIT TO SCOTLAND.—Wreck of the *London*, lat. 61½° N., lon. 57° W., April, 1817. Discovered at the Orkney Islands, lat. 59°, 20th of March, 1818.

BETWEEN NEWFOUNDLAND AND THE CANARIES.—One of the most horrid cases of a ship *water-logged*, appears to have been that of the *Francis Spaight*, homeward bound, from St. John's, New Brunswick, 24th of November, 1835; nine days after which the vessel broached-to in a gale, and lay a helpless log in the sea: sixteen days were then passed without the means of obtaining food from below, and until the *survivors* were taken off by the commander of an American vessel, the *Agenoria*. The *Spaight* was then abandoned, and ultimately drifted to the Island Fuerta-ventura, one of the Canaries, into a port of which she was towed about the latter end of May, 1836.

NEWFOUNDLAND BANK TO BRISTOL CHANNEL.—A bottle from the bark *Sarah*, of Newcastle, off the Bank of Newfoundland, in lat. 46° 2′, lon. 48° 10′, 29th of May, 1835. Found, almost covered with barnacles, near Porlock, on the South shore of Bristol Channel, 13th of April, 1836.

NEWFOUNDLAND BANK TO IRELAND.—A bottle from the Fredish ship *Elizabeth*, in lat. 47°, lon. 49° 10′, 15th of August, 1819. Found on the coast of Sligo, Ireland, 21st of June, 1820.

NEWFOUNDLAND BANK TO IRELAND.—A bottle from the ship *Hercules*, on the bank, 24th of May, 1837. Found at Tranmore, coast of Donegal, August 2nd, 1838.

EASTERLY DRIFT TOWARD IRELAND.—On the 5th of April, 1834, a ship's boat was discovered, by an officer of the Preventive Station, in Roundstone Bay, on the coast of Galway, high and dry on some rocks, at a short distance from the land. This boat, from her peculiar construction, was proved to have belonged to the packet *Thais*, Lieut. Church, from Falmouth to Halifax, 12th of December, 1833, and not since heard of. The current must, of course, have brought it from the West or W.S.W.

EASTERN DRIFT TOWARD IRELAND.—A bottle from the *Seine*, lat. 50° 45′, lon. 40° 20′, 18th of September, 1811. Found on the coast of Kerry, S.W. of Ireland (lat. 51° 30′), 18th of June, 1812.

EASTERN CURRENT TOWARD IRELAND.—A stone bottle from the *Ibbetsons*, of Stockton, on its passage from Pictou to Peterhead, 5th of November, 1826, in lat. 55° 30′, lon. 18° 20′. Picked up on the coast near Killala, 3rd of January, 1827.

EASTERLY CURRENT TOWARD SCOTLAND.—A bottle from the brig *Ardent*, John Duncan, master, from Hamburg to Newfoundland, 22nd of September, 1824, lat. 56° 58′, lon. 24° 30′. Found, 12th of March, 1825, on the sands of Dell, near the Butt of the Lewis, and the notice transmitted by the agents to Lloyd's at Stornoway, 17th of March.

NOVA SCOTIA TO IRELAND.—A bottle thrown into the sea, 20th of June, 1819, from H.M.S. *Newcastle*, in lat. 38° 52′, lon. 64° (the meridian of Le Héve Bank). Found on shore in the Rosses, on the N.W. of Ireland, immediately in the vicinity of the Isle of Arran, by Mr. Nassau Forster. There can be no doubt that, near the coast of Ireland, the current blends with the flood tide, which sets in from the S.W.

NOVA SCOTIA TO FRANCE.—The bowsprit of H.M.S. *Little Belt*, which was dismasted on the Halifax station, about eighteen months before. Picked up, 18th of February, 1811, near Basque Roads, in lat. 46°, lon. 2° W.

A *wreck*, from lat. 44°, near Halifax, was found in the Road of Aix; and a bottle, from lat. 49°, lon. 45°, came ashore near Cape Finisterre.

EASTERLY CURRENT TOWARD SCOTLAND.—A bottle from the *Sandwich*, of Dartmouth, Walter Squire, master, bound from Liverpool to Labrador, lying-to in a gale, 1st of June, 1821, in lat. 50° 16′ N., lon. 36° 25′ W. Found 2nd of December, 1821, on the western shore of South Uist, in the southern range of the Hebrides or Western Islands.

EASTERLY CURRENT TOWARD SHETLAND.—A bottle from the snow *Romulus*, Captain John Crawford, 27th of July, 1819, in lat. 57° 47′ N., lon. 20° 42′ W. Found on a beach called the Croe Air, upon the N.W. part of the Main Land of Shetland, by Charles Man, 14th of November, 1819, and made public by Mr. Gilbert Man.

NORTH OF SCOTLAND TO NORWAY.—A sealed bottle from the ship *Hecla*, dated 22nd of May, 1819, lat. 59° 4′, lon. 6° 55′ W. Found, 21st Sept., near the mouth of a river above Ræd-œ, lat. 60° 45′, lon. 4° 54′ E.

Between NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the *Royal Union*, from Quebec to Dublin, Dan. Grant, master, 27th Sept., 1822, dropped in lat. 48° 15′ N., lon. 45° 10′ W. was picked up at Scilly, 11th Dec., 1822, and transmitted to Lloyd's.

Between NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the *James Cropper*, Captain Marshall, from Liverpool to New York, 10th Jan., 1824, in lat. 48° 20′, lon. 38° 5′. Found 12th Feb., 1825, at Gunwallow fishing-cove, in Mount's Bay.

Between NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the *Three Sisters*, of Cork, Captain Pollock 30th of July, 1824, in lat. 41°, and lon. 42°, current then E. by S., 1½ miles an hour. Found, 12th Oct., 1825, in Guavas Lake, Mount's Bay.

INSET to the ENGLISH CHANNEL.—A bottle from the *Margaret*, of Glasgow, lat. 52°, lon. 24°, 1st of March, 1821. Picked up near Jersey. (*Date not given.*)

TOWARD the BAY of BISCAY, from the West.—A bottle from the *Sisters*, of London, C. Pittman, commander, 17th Sept., 1827, in lat. 44° 8′, lon. 36° 56′. Found at Biarritz, near Bayonne, in the Bay of Biscay, 2nd Oct., 1828.

SOUTH-EASTERLY CURRENT OFF CHANNEL SOUNDINGS.—In August, 1826, Captain Livingston, in the *Jane*, between lat. 48° 53′, lon. 16° 7′, and Cape Clear, had a set of 1° 14′ S. and 1° 54′ E. So that in four days the vessel was set, by a counter current, 74 miles S. and 65 E., or nearly S. 41° E. about 99 miles; equal to a daily average of 24¾ miles.

TOWARD the BAY of BISCAY.—The ship *Carshalton Park*, Captain J. Steele Park, on returning from Jamaica to London, in July, 1824, in lat. 48°, and lon. 13°, got into a stream setting to the southward, and which thence operated so strongly against the ship, that some difficulty was found in getting sufficiently far to the northward for a good Channel track. The wind shifted suddenly from S.W. to North; the vessel immediately hauled up E. by S.; and although the weather was fine, and the water quite smooth, she made no better than a true E. by N. course.

Captain Park says, "The moon happened to be near the full about this time; and I had opportunities for ascertaining the latitude by her meridian altitude three or four nights in succession before we made the land: therefore I could not be mistaken as to the strength and direction of this current; for the interval between the observations of sun and moon was only ten or eleven hours; and the greatest attention was paid to the steerage."*

Off the COAST of PORTUGAL.—A bottle from the brig *Freeland*, Captain T. Midgley (from Liverpool to Africa), in lat. 41° 50′ N., lon. 14° 23′ W., 11th of February, 1833. Picked up close to the shore, off the Harbour of Vigo, on the 1st of March following; having traversed, in a true E. ¼ N. direction, about 80 leagues.

ST. GEORGE'S CHANNEL to CAPE ST. VINCENT.—On the 14th of August, 1823, Capt. *Livingston*, in the sloop *Favorite*, on his passage from Liverpool to Gibraltar, took his departure from the *Smalls Lighthouse*, and thence he regularly made observations on the current, &c., so far as adverse weather permitted. On the 23rd he had arrived on the parallel of 46° 23′; previously to which the course seems to have been materially affected

* The same ship, on the 10th of July, was on Channel soundings, the latitude by meridian altitude of the sun, 48° 53′; the longitude, by chronometer and lunar, 9° 44′ and 9° 56′, respectively. "Kept the ship E. ½ S. and generally East till 11^h 51′ p.m., when, by the moon's meridian altitude, it was found that the latitude was 49° 11′. We had gone, during this interval of 11^h 51′, 68 miles by the log, carefully attended to, in smooth water. Now, allowing 2½ points of variation, we ought to have made 26′ of northing; whereas, in point of fact, we made 13′ only."

Influenced, probably, by the Channel ebb, the current appeared also to have a tendency to the West.

by the *tide*, but here the differences amounted to 51′ 55″ southerly, and only 4′ 39″ N. From lat. 46° 23′, August 23, to lat. 36° 52′, August 31, the current invariably predominated to the southward, and between these parallels amounted to 89 miles in the eight days.

At 4h 53′ of August 31, with Cape St. Vincent bearing true North, an excellent meridian altitude of the planet Saturn gave lat. 36° 52′ 8″. The total southing to this point gave 2° 18′, and the difference of longitude between dead-reckoning and that by landfall gave 1° 42′ 7″ of easting.

In the brig *Friends*, of Glasgow, 24th August, 1820, Captain Livingston states—" The current set us round Cape St. Vincent without our having seen the cape, though we steered courses for the purpose of seeing it, and we were looking out for it when I got a lunar, and ascertained that we were then past it. Immediately after this the sea became smooth, being broken off by the cape."

Between CAPE FINISTERRE and the AZORES, the general drift of the surface of the sea appears to be to the south-eastward; varying, however, to the East and West, and even to the northward, as the winds operate, either one way or the other, more especially during winter, as already noticed.

H.M.S. *Pactolus*, in May, 1816, experienced a current South a little East, at the average rate of 30 miles a day, from the English Channel to St. Michael's.

Captain *Charles Hare*, in the brig *Ward*, from New Brunswick, Sept., 1823, with westerly winds, which had prevailed for fourteen days, between lat. 43° 40′ and 45° 20′, lon. 22½° to 16°, found the current E.S.E. 1½ miles in the hour.

Between PORTUGAL and the WESTERN ISLANDS.—Captain *George Cheveley*, June, 1830, lat. 44° to 27°, lon. 11° to 21°, current S.E., three-quarters of a mile an hour.

Captain *W. J. Capes*, on his passage in the *Lady Mackworth*, from England to the West Indies, in August and September, 1823, found the currents as follow: taking the ship's position at noon :—

Aug. 27	Lat.	43°	38′	Lon.	12°	40′,	Current easterly.
28	...	42	43	...	12	17,	By good chronometric observation, the current had set 30 miles to the eastward.
29	...	43	41	...	12	28,	Current, 10 miles E.S.E.
30	...	41	42	...	12	28,	Current, 25′ easting and 11′ southing, by good observation.
31	...	40	3	...	13	23,	Current, 9′ to the S. and 14′ to the E.
Sept. 1	...	38	5	...	14	17,	No current perceptible in the 24 hours.
2	...	35	59	...	15	6,	Current, 26 miles to the southward.
3	...	34	8	...	15	55,	Current southerly, 3 or 4 miles.
4	...	33	1	...	16	7,	Porto Santo, distant 4 or 5 leagues.
5	...	32	22	...	16	49,	
6	...	31	16	...	17	26,	Current, 7 miles to the southward.
7	...	29	28	...	17	38,	Current, 10 miles ditto.
8	...	28	48	...	17	26,	Current, 17′ S. and 13′ E.
9	...	28	32	...	17	17,	No observation on current.
10	...	28	9	...	18	10,	
11	...	27	4	...	19	41,	Current, 16′ to the southward.
12	...	25	45	...	21	43,	Current, 15′ to ditto.
13	...	24	44	...	23	52,	Current, 4′ to the S. and 13′ W.

8th April, 1823.—Captain *Hamlin*, in the ship *George IV.*, on the passage from Greenock to St. Thomas's, found that they were much to the southward of dead-reckoning on several days, and during the last twenty-four hours not less than 45 miles. Lat. at noon, 38° 50′, lon. 19°, or more than 300 miles E. by N., *true*, from St. Michael's.

In September and October, 1775, the officers of the *Liverpool*, ship of war, observed that, in lat. 45° 43′, lon. 21° 20′, a current was found setting to the southward 12 or 15 miles per day, which continued until they made the Island of Corvo, the longitude of which, by lunars, agreed within 12 miles of the longitude by current.

Again, on the 18th of October, in lat. 42° 4′, and the Isle of Corvo bearing about S. 75° E. 154 leagues, the sea being very smooth, it was suddenly agitated into a short irregular sea (without any shift or increase of wind), such as is generally occasioned

by currents, and the next day it was found that the ship was 30 miles to the southward of the reckoning. This current (*blending with the Gulf Stream*) continued until the 22nd of October, having then arrived in lat. 37°, lon. 44° 43′ West of Greenwich, and its general rate appeared to be 1¼ miles in the hour.*

The CURRENT along the COAST of PORTUGAL appears to set nearly in the direction of that coast. On the 25th of October, 1810, a gun-boat for the service of Cadiz, being in tow of the *Rebuff* gun-brig, broke adrift in a gale of wind, in lat. 39° 44′, and lon. 9° 38′ W. On the 19th of November following, his Majesty's sloop of war *Columbine*, when cruising 8 or 9 miles to the westward of Cadiz Lighthouse, observed a gun-boat to leeward, which proved to be the identical boat that twenty-five days before had broken adrift from the *Rebuff*. The distance traversed by the boat was about 350 miles, or 14 miles a day, chiefly by the current, the wind in the meantime being so various as nearly to render the drift negative, or, if anything, against the set of the current.

On the currents setting toward the Bay of Biscay and the Strait of Gibraltar, Captain, afterward Admiral, *Sir Erasmus Gower*, made observations in five passages to Madeira, from which he concluded the most general direction to be to the S.E., and the mean velocity about 11 miles in every 50 leagues.

Mr. Robert Bishop observed, by experiment, in the year 1761, a current setting on this part of the ocean, between S.E. and South. After making some necessary corrections, he considered the current as setting at the rate of 8 or 10 miles in 100, in a middle rate of sailing. Other experiments have likewise been made, which give nearly the same result; and the observations of Captain Wm. Bligh, of his Majesty's ship *Director*, outward bound, in September and October, 1799, and made in this part of the Atlantic, are corroborative of the truth of these observations. They show, that, although the currents in those months are very variable, but setting mostly in a southerly direction, yet that between South and S.E. predominates.

In proceeding to Tenerife, Sir Erasmus Gower observed a constant current setting to the southward, at the rate of a mile an hour; equal to 22 miles in the distance between Madeira and that island.

Captain Mackintosh, of the *Hindostan*, who had made twenty passages in this route, generally experienced a current from the 39th degree of latitude to that of the Canaries. In this part of the ocean he generally found, from repeated and accurate observations, that this current set to the E.S.E. He found it strongest opposite to the entrance into the Mediterranean or Strait of Gibraltar; and, in one voyage, the current was computed, by his timekeeper, to set about 40 miles per day. This current inclines more southerly as it approaches the Canaries. It strikes on the coast of Marocco, and takes, about Cape Boiador, a different direction. Nearly in-shore, from an indefinite point, one part of the stream sets northward toward the Strait of Gibraltar, and the other part sets to the southward.

* The effect of a current setting to the south-eastward, and the necessity of a competent knowledge of currents in general, cannot any way be more forcibly shown, than by noticing the melancholy catastrophe of his Majesty's ship *Apollo*, Captain J. W. T. Dixon, and the merchant ships under her convoy, on the 2nd of April, 1804. The *Apollo*, with sixty-nine ships for the West Indies, sailed from the Cove of Cork on the 26th of March. With a fair wind, blowing strong, they steered about W.S.W. until the 31st, when the wind changed more to the westward. At noon, on the 1st of April, latitude observed 40° 51′ N., longitude, by *account*, 12° 29′. At eight p.m. the wind shifted to S.W., and increased to a gale, with a heavy sea. The convoy stood to the S.S.E., and, at half-past three next morning, struck on the coast of Portugal, in about 40° 22′ N., 3 leagues to the northward of Cape Mondego. Captain Dixon, and about sixty men of the *Apollo*, perished, in their endeavours to reach the shore; the other part of the crew remained two days clinging to a fixed part of the wreck, without nourishment. About forty sail of merchantmen were wrecked about the same time; some sunk with all their crews, and most of them lost several men. This lamentable event has been attributed to want of chronometric observations, and the consequent ignorance of the set of the current, which must certainly have been very strong.

"The immediate cause of the loss of so many of the *Apollo's* convoy appears to have been the blind confidence with which the commanders followed their commodore; either keeping no reckoning themselves, or believing his more accurate than their own. Several ships were saved by leaving the convoy: and it is said that the commander of a Clyde ship warned the commodore of his danger in time to have avoided it."—*A. L.*

M. le Baron Roussin, in the corvette *Bayadere*, bound from Rochefort to Brasil, in February, 1819, after passing Cape Finisterre, found the prevailing winds from noon to noon and currents as follow:—

	Latitude.	*Longitude.*	*Winds.*	*Current.*
Feb. 22	42° 43′ 38″	11° 40′ 6″	N.—W.N.W.	S.S.E. 24 miles.
23	40 3 28	13 44 17	N.—N.E.	S.S.E. 12 —
24	37 3 49	13 35 30	N.E.	S.S.E. 12 —
25	34 13 11	14 10 30	N.E.—S.E.	S.E. 6 —
26	31 9 17	15 14 40	N. and N.E.	S.10° E.12 —

But on arriving at the Canaries, with the wind N. and N.E., the current had changed.

On the course of the same vessel, from Brest toward Brasil, in October, 1821, the current had set on the last twenty-four hours (October 6), lat. 40° 24′ 36″, lon. 14° 29′ 30″, S. 15° E. 20 miles; on the three following days, nearly in the same direction, but with less than half the strength. In lat. 35° 20′ 50″, lon. 12° 54′ 40″, 15 miles S.E. In lat. 33° 54′, lon. 12° 48′, it had set only 6 miles S. 5° E.; but, on the next day, in 34° 18′ 24″ N., and 12° 21′ W., 25 miles S. 25° E.; and again in 34° 14′ 34″, and 12° 13′, South, 20 miles. Off the African coast, lat. 32° 56′ 20″, lon. 13° 16′ 20″, it had set 32 miles to the S.W., or in a direction nearly parallel with the shore.

At about 74 leagues W. ½ S. from Cape Mondego, on the 9th of June, 1799, M. de Humboldt, in the sloop *Pizarro*, was on his voyage toward the West Indies; and, on this day, in lat. 39° 50′, and lon. 13° 50′, he says, that they began to feel the effects of the current setting toward the Strait of Gibraltar, &c. From the parallel of 37° to that of 30° the vessel was sometimes carried, in twenty-four hours, from 18 to 26 miles to the eastward. The direction of the current was, at first, E. by S.; but nearer the strait it became due East, and it assumed a more southerly direction on the passage toward Tenerife. "Several pilots, who frequent the Canary Islands, have found themselves on the coast of Lanzarote, when they expected to make good their landing on Tenerife." M. de Bougainville, in his passage from Cape Finisterre to the Canary Islands, found himself in sight of Ferro, 4° more to the eastward than his reckoning indicated.

In July, 1816, Captain Andrew Livingston, in a run of only nine days from Ireland, during which there was no opportunity for observations for longitude, was set upward of 3° to the eastward of his reckoning; having made the Salvages, when he expected to have been to the westward of Madeira.*

The frigates *Sta. Maria de la Cabeza* and *Lucia* sailed from Cadiz, 12th April, 1795, and on the 17th, at six a.m., they made Point Naga, in Tenerife, when they found, by a comparison with their chronometers, that the current had carried them sixty-two minutes to the eastward.

Don Vincente Tofiño had, ten years before, proceeded in the *Lucia*, from Cadiz, for Mogodor; he sailed on the 27th of April, 1785, and, on the 1st of May, before midday, arrived at the last-named port. On the 5th he sailed from it, and on the morning of the 8th anchored again in Cadiz. On his voyage out, he found that the current, in four days, had set him 21¼ miles S. 18° E., and on his return S. 49° W. 39 miles. This variation of the current shows, that the waters throughout all this extent do not always run to the S.E., but that they vary, with the line of coast, to the south-westward also.

The deceased Admiral *Don Cosmé de Churruca* sailed from Cadiz on the 15th of June, 1792, for the purpose of surveying the West Indian Islands and Spanish Main. He took his *departure* at half-past three p.m., in lat. 36° 29′ 25″, and lon. 0° 6′ 40″ W. of Cadiz. In his Journal he says, "It is well known among our seamen, that in the Bight of Cadiz (that is, the coast comprehended between Cape St. Mary and Cape Trafalgar) there is a current setting constantly to the eastward; but as, near the shore, the effect of the tide

* In late years, and since I read Mr. Bain's book on the Compass, I am inclined to think that much of our error in the *Agnes* arose from the attraction of iron near her binnacle. In this vessel we had unaccountable inaccurate reckonings until I pulled her binnacle down at Kingston, Jamaica, when we found two half-inch iron bolts and ten iron spikes in the coamings near the compass. After that our reckonings were as accurate as I have seen those by account in any other vessel.—*A. L.*

must necessarily be felt, it may also modify the direction of the current. When we established our point of departure, the strength of the ebb had already begun to decrease; but as, during the early part of the night, we were unable to get any considerable distance from the shore, we consequently felt all the force of the flood tide setting to the northward; and this appears to have been the reason why we experienced a current to the N.E.; for the current which commonly sets into the Strait of Gibraltar, combined with the flood tide, ought nearly to give that N.E. direction. After our *departure*, and from midday of the 16th, we sailed with variable winds until the 21st, when the wind became fixed at N.N.E., and we found that, in the twenty-four hours, from the 21st to the 22nd, the current had set S. 42° E. 9¼ miles; though in consequence of uncertainty in the dead-reckoning, and the variableness of the wind, it is possible the error was contracted without any current; the situation at midday of the 22nd being in lat. 30° 18′ 51″ N., and lon. 8° 59′ 21″ West of Cadiz."* The intention was to ascertain the position of the Salvages, which were seen the same evening, and he then makes the following reflections:—"The whole error of longitude by dead-reckoning was 34′ 6″ E.; the sum of all the errors in latitude, after various compensations, was about 3′ 45″ to the North; therefore, the total error made during the voyage, was 34′ 6″ to the eastward, and 3′ 45″ to the southward; and as if we had experienced a daily set of 4 miles S. 82° 35′ E. The pilot's reckoning was kept by a log-line, marked to 48 English feet, for the 30 sec. glass, and was ahead of the vessel 57′ 25″ in longitude, and the sum of its errors in latitude was 8′ 39″ to the southward. According to this line, the vessel's total error was about 47$\frac{5}{10}$ miles, or 7 miles daily, N. 79° 45′ E. We see, therefore, that the knot of 50¾ English feet, indicated better the true course of the vessel until she made the Salvages, as situated by M. Verdun; and that, if it had any fault, it was that of giving too much distance, and not too little, as is commonly believed. This experiment, though not, however, sufficient to decide in favour of marking the log-line to 50¾ English feet, at least affords a presumptive proof in its favour," &c.†

H.M.S. *Pique* was once set to the S.E., 98 miles in five days, between Cape Finisterre and Madeira.‡

Mr. James Grey Jackson, in his valuable "Account of the Empire of Marocco,"§ has stated, that the coast, between the latitudes of 20 and 32 degrees North, is a desert country, interspersed with immense hills of loose sand, which are, from time to time, driven by the wind into various forms, and so impregnate the air with sand, for many miles out to sea, as to give the atmosphere an appearance of hazy weather: navigators, not aware of this circumstance, never suspect, during such appearances, that they are near land, until they discover the breakers on the coast, which is, in some parts, so extremely flat, that a person may walk a mile into the sea without being over the knees; so that ships strike when at a considerable distance from the beach: added to this, there is a current, which sets in from the West toward Africa, with inconceivable force and rapidity, with which the navigator being generally unacquainted, he loses his reckoning, and, in the course of a night, perhaps, when he expects to clear the African coast, in his passage southward, he is alarmed with the appearance of shoal water; and, before he has time to recover himself, finds his ship aground on a desert shore, where neither habitation nor human being is visible. In this state his fears are soon increased by a persuasion that he must either perish in fighting a horde of wild Arabs, or submit to become their captive; for, soon after a ship strikes, some wandering Arabs, strolling from their duar in the desert, perceive the masts from the sand-hills; and, without coming to the shore, repair to their horde, perhaps 30 or 40 miles off, to apprise them of the wreck, when they immediately assemble, arming themselves with daggers, guns, and cudgels. Sometimes two or three days or more elapse before they make their appearance on the coast, where they await the usual alternative of the crew either delivering themselves up, rather than perish with hunger, or throwing themselves into the sea.

* From Greenwich, 15° 16′ 50″, and about 40 miles to the eastward of the Salvages.—Ed.

† Farther remarks on Currents, upon the same voyages, are given hereafter.

‡ H.M.S. *Raleigh*, August, 1826, found the current from off Cape St. Mary, toward the Strait, to set W. 34° S. 26 miles in the twenty-four hours.

§ London, quarto, 1809. See, also, the affecting "Narrative of the Shipwreck and Captivity of M. de Brisson," in 1787; and that of Robert Adams, wrecked in the American ship *Charles*, John Horton, master, 1810. The latter is noticed more particularly, with others, in the Description of the Coasts of Africa, hereafter.

But to resume the description of the currents:—M. de FLEURIEU, in his admirable illustrations of the voyage of *Etienne Marchand* around the world, has paid very particular attention to the set of the currents throughout the whole of the route, and his remarks corroborate very clearly the facts already described. In that work M. Fleurieu states, that in a run which he himself made, in 1768-69, in the *Isis* frigate, from Cadiz to Tenerife, by a direct course, and with a steady breeze from N.E. to E.N.E., he had an opportunity of ascertaining the constant effect of the current, which sets to the eastward so long as a ship sails in the tract of sea situated to the westward of the Strait of Gibraltar, and at a little distance from it. Clear weather permitted him, during the four days employed in this run, to take daily observations for determining the longitude of the ship, by the help of the timekeepers of *Ferdinand Berthoud*, of which the daily rate had been ascertained at Cadiz; and in comparing every day the ship's progress toward the West, deduced from the observations, with that indicated by dead-reckoning, there appeared the following results:—

On the first day, the current had set to the eastward 11¼'; on the second, 12¾'; on the third 9⅓'; on the fourth, 1'; when the current ceased, in lat. 31°, to be perceptible.

Therefore, during the first three days, the movement impressed on the ship to the eastward, carried her toward that side 33⅓', or 27¾ miles; and, by a mean, about 8 miles in twenty-four hours.

The quantities which the ship had been carried, in the same interval, toward the South or toward the North, had nearly counterbalanced each other: 8⅔' to the southward, 6⅛' to the northward.—(*Voyage de l'Isis, en* 1768 *et* 1769.)

The ship of *M. Marchand*, named the *Solidè*, left Cape Spartel, bearing South, on the 29th of December, 1790, and made the Peak of Tenerife, bearing S. 6½° E. about 35 leagues distant, on the 5th of January, 1791. In this time it was found that a current had set the ship 39 miles E. 13° S., equal to a mean drift of 5·8 miles per day of twenty-four hours.

From the 5th to the 9th of January, inclusive, when the ship, on the latter day, was in lat. 21° 24', lon. 19° 26' (from Greenwich), it was found that the current had set her 50⅓ miles farther E. 13¾° S., being at a mean rate of 12⅔ miles in twenty-four hours.

Between lat. 21° 24', lon. 19° 26' (as above), and the Isle of Mayo, during an interval of five days, the ship was carried, by the current, 35½ miles W. 30¾° S., or at the mean rate of 7·1 miles in twenty-four hours.

The *Solidè* sailed, on the 18th of January, from Port Praya, St. Iago, on her progress toward Cape Horn; and, although no observation of longitude could be taken, it subsequently appeared, by observations of latitude, compared with the reckoning, that, in the interval from the 28th to the 31st of January, the ship was carried to the *northward* fifty minutes beyond the run by account; that is, at the rate of 16⅔ miles in twenty-four hours.*

As no observations were made for the longitude since the time of departure from La Praya, it cannot be known whether the current, which set to the northward, set at the same time to the eastward or westward; it may be presumed, that its direction was rather toward the latter; because the observations that were made on the 6th of February following, in lat. 5° 38' S., and 25° 38' W., indicated that, in the interval from the 18th of January to the latter day, the ship's progress toward the West had been greater, by about 21 leagues, than that which was deduced from the dead reckoning.

In July, 1792, the *Solidè* returned to the westward and northward of the Azores; and, on the parallel of 41° 42', at the distance of about 2° North of Corvo, she had a set in one day of 9 miles S. 29° E. Proceeding thence toward Lisbon, she appeared to have a set, in three days, of 27 miles W. 19° S., equal to 9' per day in that direction; but, in the following six days, from the N.E. of the Azores to Cape St. Vincent, the current set 74 miles E. 25½° S., equal to 12·3' per day; and between Cape St. Vincent and Cape Spartel, in forty-two hours, she found an indraught of 30 miles East, equal to 17½' per day, setting toward the Strait of Gibraltar.

AFRICA.—The ship *Montezuma*, of Liverpool, Knubley, master, sailed on the 26th of October, 1810, for Brazil, but was wrecked on the 23rd of the next month, at three a.m., on the African coast, somewhere between Capes Noon and Bojador. Among the crew, who were taken and sold by the Arabs, was Alexander Scott, an apprentice: this person

* This must have been by the Equatorial Current.—ED.

was detained in the country for nearly six years; and a very interesting account of his captivity, drawn up by Dr. Traill, with geographical observations on his routes, and remarks on the currents which produced the catastrophe, by Major Rennell, were given in the fourth volume of the *Edinburgh Philosophical Journal*. The latter are as follow:—

Major Rennell's Remarks on the Currents between Cape Finisterre and the Canary Islands.

"I should consider myself highly culpable, if I neglected to state, by way of caution to navigators, the result of my inquiries respecting the currents which appear to have caused the shipwreck of the *Montezuma*, and of a great number of other ships of our own and other nations, on the western coast of Barbary; having examined a multitude of journals of ships that have sailed in that track, with timekeepers on board, and which have also, when opportunities presented themselves, had their rate checked by celestial observations.

"The general result is, that navigators, who depart from the parallel of the southern part of the Bay of Biscay (or say 45°), and sail in the usual track southward, will be assailed first by a *S.E.* current, and then by an *easterly* one, until they have passed the parallel of Cape Finisterre; when the current will again turn to the *South* of *East*, and gradually become a S.E. current, till, having passed Cape St. Vincent, it becomes easterly again; owing, no doubt, to the indraught of the Strait of Gibraltar; and this easterly current is pretty general across the mouth of the bay, between Cape St. Vincent and Cape Cantin.

"Beyond this bay (which may be termed the *funnel*, of which the strait itself is the *spout*) the current again becomes S.E., or rather more southerly (as it is more easterly toward Cape Finisterre), and continues as far as the parallel of 25°, and is, moreover, felt beyond Madeira westward; that is, at least 130 leagues from the coast of Africa; beyond which a S.W. current takes place, owing, doubtless, to the operation of the N.E. trade-wind.

"The rate of motion of this current varies very considerably at different times; that is, from 12 to 20 or more miles in twenty-four hours. I consider 16 as rather below the mean rate. I have one example of 140 miles in eight days, in one of his Majesty's ships, equal to 17½ miles per day; and, in another, of only 12. And in a very well kept East India ship's journal, 170 in nine days to Madeira, or 19 per day. The direction of the stream likewise varies, but commonly more toward the *South* than the East, after passing the mouth of the strait.

"Near the coasts of Spain and Portugal, commonly called the Wall, the current is always very much southerly, owing, perhaps, to the falling in, obliquely on the shore, of the great mass of water brought by the S.E. current; which can run off only toward the South, and round Cape St. Vincent toward the strait's mouth. And amongst the Canary Islands, and between them and the coast of Barbary, the currents are less regular.

"It may be taken for granted that the whole surface of that part of the Atlantic Ocean, from the parallel of 30° to 45°, at least, and to 100 to 130 leagues off shore, is in motion toward the mouth of the Strait of Gibraltar.

"According to what has been said, in the course of the above remarks, it must be expected that a ship sailing in the usual track to Madeira or the Canaries will be carried to the *south-eastward*, at the rate of 16 miles per day, that is, even if she has a fair wind, she will be carried by the current 150 or 160 miles to the south-eastward, in the course of her voyage to Madeira or the Canaries; and, consequently, on a *S.E. by S.* course will be carried 80 or 90 to the eastward of her intended port. If we suppose a *S.E.* course, the error in easting will be no less than 109; which distance, if they are bound to Tenerife, would carry them to Allegranza or Forteventura: and, if intending to make Allegranza, would place them on shore on the coast of Barbary. The French and Spaniards report that their ships have often made Allegranza when they supposed themselves on the line toward Tenerife. It must be added that, if a ship had a long passage, the error would be greater in proportion, and might possibly amount to 200 miles of easting.

"It would seem advisable, therefore, that every ship going to the Canaries, or intending to sail between those islands and the main land of Africa, and being without timekeepers, as that class of merchant ships commonly are, should, to every day's reckoning, *add ten miles of easting*. This would, in the first instance, prevent them from *deceiving themselves*

as they went forward; in like manner, as it is better to set a clock forward at once, than to charge one's memory continually with its being too slow. *Ten miles* do not seem too much as a cautionary measure, as a ship has very lately been carried 99 miles to the *East* in eight days in that track. What would not have been the error had she had even a moderately long passage?

"It is this current which has furnished the roving Arabs of the Desert with their victims from every nation, and the good Mr. Willshire* with objects of benevolence."—27th February, 1819.

The *Eliza*, commanded by John Searchwell, sailed from Cork for Rio Janeiro, with settlers, on the 12th of August, 1827, and ran ashore on the coast of Africa, during a fog, on the 25th of the same month. Whilst making signals of distress, three fishing-boats, from Canary, came to her assistance, and succeeded in saving all the lives on board, consisting of 18 mariners, 244 men, 46 women, and 42 children; in all, 350 persons, who arrived at Canary on the 3rd of September.

About the end of October, in the same year, the *Olymphe*, from Havre for Buenos Ayres, with colonists, was cast away on the same part of the African coast. The passengers, about 300 in number, consisting of French, English, Germans, and Swiss, were taken from the shore, saved from captivity by Canarian fishing-boats, and conveyed to the Grand Canary, where they were landed on the 7th of November. Such have been, even within a few years, the effects of the current!

The preceding description of the currents between the English Channel and Canary Islands was corroborated, in 1826, by Captain R. H. Newby, in the *Napoleon* schooner, which left Dartmouth on the 21st of July, and was set to the eastward of reckoning, while crossing the Bay of Biscay, 1° 21′ of longitude in forty-eight hours. On Monday, the 25th of the same month, the entrance of Ribadeo bore S.W. by compass, about 15 miles, and the vessel was then in about 6° 55′ W.

The effect of the easterly current was proved by the bearings of a remarkable mountain inland, and some whitish cliffs on the shore; and Captain Newby says, the schooner was setting to the eastward quite as fast as I have noticed a ship to lose ground to the eastward while standing in-shore off Beachy Head during a strong flood tide and moderate westerly breeze. At about five p.m. the wind veered to the N.E., and even then, although the vessel was going at the rate of 3½ knots through the water, she made very little way to the westward till toward sun-down, when the breeze freshened to 7 or 8 knots.

During the night, passed Cape Ortegal; and the next morning, at six a.m., the light-tower at the entrance of Corunna bore South.

It did not appear that the current relaxed in strength between the time of observing the inland objects, and that when the wind freshened. Mr. N. adds, that this is the third time he has experienced its effect, without ever perceiving it to set at all to the westward. The last time previous was on the 9th and 10th of September, 1835.

At three p.m., July 27th, 1836, Cape Finisterre bore E.S.E. by compass [*true East*], distant about 12 miles. A fresh breeze from E.N.E. prevailed up to the following noon, when the current had set to the southward about 14 miles, as frequently found on the Portuguese coast at this season of the year.—(*See page* 198.)

July 28 to August 1, inclusive, variable weather and north-easterly winds to lat. 29° 15′, lon., by account, 19° 52′ W. On the 1st of August it was found that the schooner had missed Madeira in her attempt to make and pass the West end of that island, and at one p.m. the dark, bold, northern end of Palma came in sight from under a dispersing cloud, and bearing by compass about W.S.W., distant 7 leagues.

Upon going over the last two days' work, it appeared that, instead of passing, as supposed, to the westward of Madeira, the *Napoleon* was actually without a sight of the island to the *eastward*, and had the vessel been involved in fog, or have been bound to Lanzarote or Forteventura, and steering, by reckoning, a fair course for them, the consequence must have been that she would have fallen into broken water, when least expected, or have grounded on the main shore, somewhat between Cape Ghir and Cape Noon, and property, if not life, would have been lost. It is, moreover, to be observed, that the sea had been, for the most part, comparatively smooth: had there been a strong N.W. swell,

* William Willshire, Esq., the English Consul at Mogodor, to whose active goodness Scott and many others owe their deliverance from slavery.—Ed.

such as is commonly felt toward the mouth of the Strait of Gibraltar, then the vessel must have been set still farther to the eastward of her reckoning.

After making the North end of Palma, the breeze continuing rather light at N.E., the vessel hauled on a W.N.W. course, in order to get to the westward of the island, and so as to avoid the risk of getting into the calms or eddy winds to leeward of it; but up to sunset she made very slow progress westward; the swell was short and cross from the northward, and there appeared to be a strong current from the N.W. toward the island, and the captain found it necessary to steer N.W., but still the vessel was found to be approaching the North side of the island. At nine p.m. he began to be alarmed at his proximity to land; braced up the yards and trimmed sails by the wind, but the breeze died away so light, and the swell kept up so cross, that at ten it was thought the vessel must be driven upon the island, unless a spot could be found for the anchor to take hold of; but, in about half an hour after, it was found that they had gained a different stream of current, and the vessel was visibly set from a S.S.E. to a S.W., or to the westward of a S.W., direction; and after passing a headland which appeared in the night to be the N.W. part of the island, and sloping toward the sea, the breeze again freshened, and the vessel increased her distance from the black and inaccessible looking shore of Palma.

Captain FitzRoy, in H.M.S. *Beagle*, January, 1832, states that, on proceeding southward, "During the whole of the 7th, the Peak of Tenerife was visible; but on the following day no land was in sight, and the ship made rapid progress. A very long swell from the N.W., which was felt until the 10th, was probably caused by a gale in the Northern Atlantic; and judging from its size and velocity, I should think that it could not have subsided before traversing many, perhaps 10, more degrees of latitude; which would be to about 10° N. It is interesting to notice how far the undulatory movement of water reaches; in this case it extended through at least 10 degrees of latitude, where the wind was from different quarters, and probably much farther."—(Vol. ii. p. 49.)

January 15.—"In consequence of a thick haze, very prevalent about the Cape Verde Islands, land was not distinctly seen until we were within 3 miles of it, and we then found ourselves rather too far westward, owing to a current setting toward the West, at the rate of 2 knots an hour; this was close to the North point of St. Iago. Next day we anchored in Port Praya."

The Baron Roussin's Remarks on the Currents between Cape Bojador and the Isles de Los.

The general currents on the African Coast, between Cape Bojador and the Isles de Los, with the exception of some places subject to a more or less regular tide, are uniform during the eight months which comprise the fine season. They follow exactly the trend of the coast from North to South.

From Cape Bojador to the Bay of St. Cyprian (lat. 22° 20′) they therefore set to the S.S.W., from that bay to Cape Blanco; and along the whole extent of the Bank of Arguin to its western point, which is in the parallel of 20° 6′ 20″ N., they set S. by W. To the southward of this point the waters, being no longer guided by the edge of the bank, which turns abruptly to the S.E., do not follow in a body, within a certain space, any fixed or determined direction. One part of their mass experiences a number of irregular windings, until finding itself in the active body of the general current, which left the bank at its most salient point, it rejoins it, and is carried on as before.

In the vicinity of Tanit Bay, in the parallel of 19° 10′ N., it again resumes its former direction, and follows the trend of the coast, thus setting to the southward as far as the two Palms, near Portandik, and from thence S.S.W. to the Marigot of Musquitoes. It then sets S. ½ W., till abreast of the Bar of the Senegal, where, in a space of 4 leagues in circumference, it is disturbed by the stream of that river. This stream is so strong as to oblige vessels at the anchorage off the bar to tend to it, in spite of the strongest winds. The current, joined by the waters of the Senegal, pursues its course along the coast, which trends to the S.W., observing a very gentle curve, which forms the Bay of Yof, and which terminates at Cape Verde. The strong currents hitherto pretended to set into the Bay of Yof are, therefore, merely chimerical, and the depth given to this bay in all the charts is no less so. Cape Verde being the most western point of Africa, and hence forming an obstruction to the general direction of the waters which flow along that coast, must occasion a great variety of currents in its vicinity. It is, in fact, what takes place, and

it would, therefore, be difficult to define a particular one. This only appears certain: vessels passing in sight of Cape Verde are not carried on it, as is generally supposed; but, on the contrary, they are swept off by the prevailing tendency which the waters have to flow to seaward. In running close to the Almadie Rocks, this repulsion is sensibly felt during the eight months which I have mentioned: it appears that the current rushes between the rocks, and spreads itself in different directions.

Immediately to the southward of Cape Verde the current is almost imperceptible, and it is scarcely possible to assign any particular direction to it as far as Cape Naze. The whole of the coast lying between this cape and Cape Manual forms a well-defined bay, totally free from current, and in which there is not a single river. The same is observed with respect to the roadstead of Goree, although, according to the observations of Mr. Adanson, a regular tide exists there, with a rise and fall of 2 feet 6 inches. In the offing of Cape Verde the current has been always found to set to the southward. From Cape Naze it again follows the direction of the coast, interrupted only at the mouths of the principal rivers, which lie between this cape and Cape Roxo. From this point, localities of a very different nature produce particular effects in the current. The Archipelago of the Bissagos here succeeds the straight coast which extends to the northward. Large rivers empty themselves amongst these islands, forming various channels, more or less encumbered with sand-banks. These obstacles cause a variety of currents, which will be explained when treating on the Bissagos.

Strength of the General Current.—The rate of the general current on the African coast, deduced from numerous observations, has never exceeded a mile and five-tenths per hour on the coast itself, and on the outer edge of the banks; and more frequently it has been found from seven to nine-tenths of a mile. This is diminished one-third, and frequently one-half, at a distance of 4 leagues from the coast. Should a vessel have run past her port, there is no fear of her stemming this current, and, by long boards, easily regaining her destination.

In the rainy season, which is from the commencement of June to the end of October, as the winds blow from various directions, the currents are no longer regular, and it is impossible to establish any positive law respecting them; but, even under these circumstances, their strength is not so great, but that it may be surmounted.

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3. THE AFRICAN OR GUINEA CURRENT;

BEING AN EASTERLY STREAM ALONG THE COAST OF AFRICA, INTO THE BIGHTS OF BENIN AND BIAFRA, WITH A WESTERLY OUTSET FROM THE SAME.

The great current from the N.W., partaking both of *drift* and *stream*, begins to change from S.W. to South immediately after passing the Cape Verde Islands, whence it becomes first southerly, and afterward gradually winds round to the S.E., and finally to E.S.E. and East: but it varies so slowly, that its western border will still be found about the meridian of St. Antonio (25°), in lat. 8° N.; from whence, turning more toward the East, the same border will again be found in about lat. 4° N., and lon. 20° W.

At the distance of about 50 leagues South of Cape Palmas (lon. 7¾° W.) the outer border of the Guinea current sets to the East; and the same direction of it continues to a similar distance South of Cape Three Points (lon. 2° W.): we thence, at 2° North of the Line, find it take a more northerly course, toward the Bight of Benin and the Bight of Biafra; in the latter it mixes with the waters of the *South African Current*, which, coming from the South, set thence to the North and N.W., and both, uniting, form a head in the bight. From this bight and southward of the Equator the currents thus blended set to the S.W., W.N.W., and N.W., in one expanding and united stream, which greatly facilitates the passage of ships from Fernando Po to Sierra Leone.

The GUINEA CURRENT, therefore, insomuch as it is a continuation of that off the coast already described, winds round in the offing, and nearly in the direction of the bank off the coast, to the S.E. and East; and under the meridian of 11° West has been found to set at the rate of 25 miles to the E.S.E. in the twenty-four hours. Increasing in strength off Cape Palmas, it then sets to the East and E.N.E., at the rate of 40

miles; off Cape Three Points, and thence to the Bight of Benin, at the rate of from 30 to 15 miles.

The prevalence of the Harmattan wind, which has been described, must interrupt the course of this current; but its existence, at other times, nearly as described, has long been confirmed, and is incontestable. The reader may, however, here refer to the remarks of M. La Pérouse, on crossing the Line, p. 120.

Near Cape Mount the current sets in toward the shore.* On the western side of *Cape Palmas* it sets along shore with such force to the S.E., that ships which do not steer a point nearer than the true course will be carried from the land. About *Cape Three Points*, likewise, the stream runs strongly to the eastward, and frequently sets directly in upon the reefs about that cape. Eastward of this cape the current has carried many experienced mariners, bound to Cape Coast or Annamaboe, to leeward of those ports, and occasioned much trouble, with delay, in beating up again. About *Terra Formosa*, in July and August, the current has also been found to set strongly to the eastward.

The *Equatorial Current*, which sets from the Bight of Biafra, and then westerly to the southward of the Line, has been illustrated, as already explained, in our '*Directory for the Ethiopic Ocean*,' by Mr. Jas. Finlaison. That gentleman has shown how, by taking advantage of it, ships may effect, without difficulty, a passage from the bight to Sierra Leone. His instructions are as follow:—

"*Ships bound from the Bight of Biafra to Sierra Leone*, if from Calabar River, when the wind does not permit them to proceed by the N.W. of Fernando Po, may pass between that island and Camaroens River, when they will find a strong current setting to the southward, out of the River Del Rey. After they have advanced to the southward of Fernando Po, they must endeavour to make all the southing and westing they can; passing either to the eastward or northward of Prince's Island, as winds will permit. On the East side of this island the current sets strongly to the southward, at the rate of a knot and a half; westward of Prince's Island, it generally sets strongly to the N.E. at the same rate.†

"Having arrived to the southward of Prince's Island, if the ship will lie no higher than W.N.W., tack immediately, and try to cross the Line; for by so doing you will keep out of the strong N.E. current that sets toward the Bights of Benin and Biafra. After you have crossed the Line, you will find that you are nearly out of the easterly current. In the parallel of 1° South you will find the current set to the westward, at the rate of one mile an hour. *In the month of May or June*, when the sun has a high declination, the trade-wind is far to the southward, and you will not gain the regular breeze nearer than in 3° South. This breeze commences from S. by W. As you make westing, the wind will be found to haul more to the southward and eastward, and the current increases to the rate of 1½ knots in an hour, until you arrive as far to the westward as 15° West. On proceeding hence to Sierra Leone, come no farther to the eastward than 15° West, until you are as far to the northward as 8° 30′ N.: then you may steer boldly

* The ship *Charles*, a French whaler, in 1833, was wrecked on the coast at about 30 leagues to the S.E. of Cape Mesurado, probably on the reefs near the River Sestros. This vessel had left the port of Havre for the fishery near *Tristan da Cunha*, in the Southern Ocean, but the captain, while intending to run along the coast beyond Cape Palmas, in the hope of falling in with whales, unfortunately lost his reckoning, by being deprived, for forty-eight hours, of all means of taking observations; and was moving at the estimated rate of 7 miles an hour, when he found himself close on shore in the midst of breakers, which in the course of the night forced him on the reef and dashed the ship to pieces. The captain and crew got safe to land, but were soon stripped by the blacks, and the captain himself left without covering. In this condition they made their way along the shore to the N.W., until they reached Cape Mesurado, where they were received with all kindness by the colonial agent of *Liberia*, who sent them in a small government schooner to the Isle Goree. The catastrophe is evidently attributable to an easterly current.

† In the last edition of the *Derrotero de las Antillas* the following remarks are said to have been found among the papers of the deceased Admiral Don Josef Varela. "At Prince's Island, and in its vicinity, the waters generally run to the *North*, which circumstance ought to be kept in mind in making the island and steering for the anchorage. There are also currents to the *South*, but they are not so strong, or of so long duration. The pilots of the place say that the currents depend on the phases of the moon, but we found that they were irregular." From this we may infer that there is some irregularity in the outset or revolving current; for which, consequently, every precaution should be taken.

in for the cape. You will strike soundings in that parallel in 14° 40′ W.; and as you approach the cape the soundings will be found very irregular, from 20 fathoms to 12 at a cast. You will then be 7 leagues from the cape, and in the fair track of the river.

"Having given these directions to our prize-master, they generally made the passage from Fernando Po and Bonny in five weeks; merchant vessels have frequently been three months, by keeping in shore."

In his investigation of the Guinea Current, *Major Rennell* says:—"I have now brought you to the Cape Verde Islands, by what is called the *Outer Passage*, and which is to be preferred, at all seasons, for ships bound to the southward; because, even when the S.W. monsoon prevails,* between lat. 15° and the Equator, and you are compelled to go to the eastward (between June and September), you will be farther to windward, and will have a more steady wind, and favourable current to the S.E., than near the coast of Sierra Leone, &c. But if you are bound to Sierra Leone you will of course keep a southerly course from the Canary Islands (Palma and Ferro), and you will find a favourable current the whole way to that place.

Although you will, at this season, carry a fair wind with you to Sierra Leone, yet it may be proper to inform you that, within the space, lengthwise, between Cape Verde and Cape Mesurado, and in certain places to the extent of 70 leagues off shore (50 off Sierra Leone), a regular change of winds and currents takes places, according to the seasons; that is to say, a N.E. or North wind and S.E. current from September to June; and, in the rest of the year, S.W. wind and N.E. or northerly currents, in effect, a *monsoon;* and this extends, in respect of the winds, nearly through the whole space between the two continents.

The current in the offing, in the parallels South of *Cape Roxo*, 12½° N. continues its course, gradually bending more and more to the south-eastward, till about the latitude of 5° N. it turns decisively to the East; and running with considerable rapidity sometimes at the rate of 2 knots, it ranges along the whole coast of Guinea until it is partly dissipated in the Bight of Benin, &c. The *Guinea Current* may be taken at 60 leagues in breadth; its greatest rapidity is during the season of S.W. winds in the sea lying West of Sierra Leone and South of the Cape Verde Islands.

It has been shown that periodical winds (in other words, a *monsoon*) prevail on this coast. It is also known, from the journals of the *Grenville* and *Royal Charlotte*, E.I.M., both of which coasted the western shore of Guinea, that is, *between Cape Verde and Cape Mesurado*, a space of about 200 leagues, the former in *June*, the latter in *January*, that, during the former period (June), which was that of the *northerly* winds, a current, which might be called the *inner* current, ran to the *south-eastward;* but, in the season of *southerly* winds, the contrary or north-westward; that is, in both cases, the *current* ran to leeward, and also nearly along shore. This inner current, then, in the season of northerly winds, is of course blended with the eastern border of the great current from the N.W., which has been described as passing along the coast, and occupying a space of 3° in breadth. But, in the season of southerly winds, the inner current runs, in the nature of an eddy, between the south-easterly current and the shore, from which, it may be concluded, it does not extend far out.

A bottle from the brig *Freeland*, Captain T. Midgley, of Liverpool, in lat. 1° 13′ S. and lon. 4° 11′ W., 31st July, 1835, picked up in the surf at Grand Sestros, lat. 4° 39′ N., lon. 8° 6′ W., on the 15th of November following; and forwarded to England by Captain Penrice, of the brig *Meg Merrilies*, belonging to the same owner. This was probably carried on a circuitous route to the westward by the stream South of the Line; and thence to the North and N.E. by the in-shore current.

* The term MONSOON, or rather *Mousoon*, among the native mariners in the Indian Ocean, is said to mean nothing more than *season;* that is, the vicissitudes or changes of season.

By a *partial monsoon* is meant a periodical wind, or stream of air, which does not extend all the way across the sea, as on the coasts of Brazil, Africa, &c.

4. THE CENTRAL DRIFT CURRENT, BETWEEN THE AZORES AND BERMUDAS, ETC.

The easterly and south-easterly currents, which have been described in our preceding pages, do not prevail to the S.W. of the Azores. On the contrary, to the W.S.W. and S.W. of those islands, the currents appear to fall into the *Sargasso Sea;* and to the southward of the tropic, far to the West, they blend with the *Equatorial Current*, which sets from E.S.E. to W.N.W. and West. Toward the West they occasionally extend to the northward of the Bermudas; and even unite with the southern edge or *reflow* of the Gulf Stream. The recent examples of them which we have to adduce are not numerous, but they are satisfactory; they also accord with natural facts, and are in unison with that theory which derives its currents from the rotatory movement of the earth, and the operation of the trade-winds.

SARGASSO SEA.—Having mentioned the *Sargasso Sea*, it here becomes proper to notice, that the portion of the ocean bearing this name is that central portion distinguished by the weed called *fucus natans*, or floating weed. The name was imparted by the early Portuguese navigators, who called it *Sargaçao* or *Sargasso*, from the form of the seed pods, or fruit of the plant, which have been called tropical *grapes*. It is described in its proper place, in a subsequent part of this work, but requires a general notice here, in its relation to the currents.

The fucus natans, by our sailors called *gulf weed*, occupies a vast space between the parallels of 37° and 18° N., and between the meridians of 33° and 43° W. This space is commonly studded over, like an inundated meadow, with the bushes, which are in some places very abundant, and in others more dispersed. "If we could imagine the surface of a wide extended moor, covered with water, the furze and heath bushes would appear something like the clusters of fucus scattered over the thickest part of this sea."

The Sea of Sargasso may be considered as an eddy, situate, in point of latitude, between the regular equinoctial current on the South, setting to the westward; the south-easterly current from the northern sea, on the East; and as the recipient of the Gulf Stream from the North and N.W. The tract which it occupies is more than 1,200 miles in length from North to South, and within these limits the weed appears in greater quantities than elsewhere: and it does not appear to have varied its position in any great degree during the last fifty years. Hence it appears to have been stationary for ages; perhaps from the time of Colombo or Columbus, by whom it was first noticed.

Major Rennell has noticed that the breadth of this mass of weeds is small in proportion to its length; being drawn out into a kind of stream, and bending a little to the east of South. Dr. Franklin crossed it in about lat. 36½°, and found it less than 50 miles in breadth, but it spreads to the southward; and in lat. 20° appears to have been at times 150 miles wide; although, perhaps, consisting of various parallel streams of weed.

It has been observed that the waters of the Atlantic have a greater tendency toward the middle of the ocean than otherwise, and this seems to indicate a reduced level, forming a kind of hollow space or depressed surface. It is certain that the setting of the currents is such as might be expected to take place if such a hollow existed; for the currents do really set into the Sargasso Sea from the North and from the South; whilst in the middle part, although within the region of the trade-wind, the currents are not regular, but indicate a kind of vortex."*

From the great central mass, portions of the weed appear to be carried by the drift to the S.W. toward the Virgin Isles, Porto Rico, &c., until they fall into the great Equatorial Current; and we have the authority of an officer for stating that, on a voyage to the West Indies, in May, 1833, after passing far to the southward of the Canaries, a first patch or field of weed was found on the 26th of May, in lat. 20°, and lon. 49°; the weed was afterward found in lat. 18¼°, and continually observed from this time to the close of the voyage to New Providence, increasing in quantity on approaching the Virgin Isles, but in *detached* pieces. The greatest quantity was found on the 28th of May, in 19° 15′ N. and 53° 44′ W., and on the 6th of June, in 21° 50′ N. and 63° 11′ W. Large compact fields were not met with until the return of the vessel in passing the latitude of 20° N.

* Rennell's "Investigation," p. 72.

Captain Bourke, in the brig *Archibald*, December, 1815, found large quantities of the weed near the parallel of 20°, to the northward of the Island Porto Rico, and of the eastern part of Hayti: but on his passage through the Bahama Channel, eastward of the meridian of 70°, and on the North sides of Hayti and Cuba, none of the weed was seen. This may be accounted for on the supposition that it was drifted by the current from the great bed of weed to the N.E., as before explained.

Among the communications which we have received from Lieut. John Evans, R.N., is the following:—"In November, 1810, H.M.S. *Belvedere*, in the centre of the Atlantic, lat. 33° 20′, lon. 41° 37′, passed through prodigious quantities of *fucus natans*, in line North and South, as far as the eye could see; and notwithstanding that there prevailed a very heavy swell from the North, their position was not altered. The quantity of this weed met with between the 30th and 36th degrees of latitude is really astonishing; at times you may sail for leagues through it, covering, as a mantle, the surface of the sea: I have often seen it in lines about 300 or 400 fathoms in length (sometimes only a few yards), and frequently in large and small patches of irregular shape, but generally in a circular form. The deep-sea line should be put over the side frequently in this particular part of the Atlantic."

In the year 1825 the brig *Erin*, from the Pacific Ocean to Liverpool, when to the westward of the Azores, passed compact parallels of *fucus natans* in lat. 39° 59′, lon. 33° 46′. The weed was less broken than any they had before seen; the nodules large and of a deep yellow-brown colour, and the lines extending, as far as the eye could reach, in a direction about S. by E., being nearly at right angles with the vessel's line, which was E. by N. The wind was S.E. by S., strong gales and a heavy sea.

The CURRENT, to which we now revert, is the great DRIFT of the ATLANTIC, under the influence of the N.E. trade-wind, and it reaches, in a S.W. and W.S.W. direction, to the West Indian Islands. Of its operation there scarcely requires a demonstration, but the following are examples.

Captain J. W. Monteath, on his passage from Liverpool to Norfolk, in Virginia, in February, 1816, between the Island of Terceira, Azores, and lat. 32°, lon. 45°, in a run of eight days, by lunar observations, found the current had set the vessel *three degrees* to the W.S.W. of the reckoning: but from this position, until his arrival in the Florida Stream, little or no current was found.

In 1823 the corvette *Bayadere*, Captain Roussin, on approaching and passing the Azores, upon her return from Rio Janeiro, Nov. 20 to Nov. 25, found the prevailing Winds and Currents as follow:—

	Latitude.			*Longitude.*			*Winds.*	*Current.*		
	°	′	″	°	′	″		°	Miles.	
Nov. 20.	26	48	12	33	24	50	E. by the S. to W.	S. 46 W.	23	CENTRAL CURRENT, westward of the Azores.
21.	37	42	3	31	16	15	N.N.N. to W.S.W. by the W.	S. 10 W.	24	
22.	38	13	56	27	43	40	N.N.W.	S. 8 E.	24	
23.	39	36	21	25	3	15	N.N.W.	S. 65 E.	28	S.E. CURRENT, eastward of the Azores.
24.	40	16	0	23	29	0	North.	S. 50 E.	13	
25.	40	25	50	22	53	20	East.	S. 75 E.	10	
26.	41	48	50	19	15	50	S.S.W.	S. 70 E.	11	

Here, therefore, the line of distinction was experienced in a very sensible degree.

In June, 1816, H.M.S. *Pactolus* experienced a southerly and south-westerly current of 10 miles a day between St. Michael's and lat. 36°, lon. 42½°. This must have been on the tail of the Gulf Stream and in the Weedy Sea. The *Pactolus* felt no other current on her way to the Bermudas until she came within 70 miles of those islands, and then had a current of 13 miles a day W.S.W.

It has been stated by *Sir Philip Broke*, that, when cruising to the southward and eastward of the Bermudas, in 1811 and 1812, there were strong currents running to the S.W. or W.S.W., and that he spoke with many vessels from the West Indies, Carolina, and Florida, going toward England, which had been driven from 10 to 12 degrees of longitude to the westward of their reckonings: and some which were not advanced 500 miles on their way from Amelia Island (Georgia) were half that distance out in their account of longitude. It was Sir Philip's idea, that "beyond the southern boundary of the Gulf Stream, from the Azores toward the Bermudas and Bahamas, there is a strong set to the S.W. or W.S.W."

WESTERLY DRIFT TO ST. EUSTATIUS.—A bottle from the ship *Wm. Miles*, Captain Jas. Pike, bound to Jamaica, lat. 18° 28′, lon. 57° 20′ (date omitted). Picked up on the beach of St. Eustatius, 26th of February, 1839.

CENTRAL DRIFT TO THE BAHAMAS.—A bottle from the ship *Wellington*, Captain Liddel, in lat. 17° 55′, lon. 39° 0′. Picked up by Captain Rodberd, of the American brig *Patriot*, on the eastern shore of Abaco, Jan. 1, 1837.

A bottle from the brig *Sir Charles M'Carthy*, of London, Captain C. M. Field, from Demerary, toward London, 15th Oct., 1824, in lat. 22° 0′, lon. 53° 30′; found at the S.E. end of St. Salvador or Cat Island, 29th May, 1825.

CENTRAL DRIFT to CUBA.—A bottle from the ship *Kate*, Captain F. F. Cresswell, in lat. 24°, lon. 19°, on the 27th of June, 1825; found on the coast of Cuba, 30 leagues to leeward of Baracoa, in about lat. 22°, and lon. 76°, 28th Nov., 1826.

CENTRAL DRIFT to the CAYCOS.—A bottle from the *Countess Dunmore*, J. H. Robertson, in lat. 27°, lon. 28°, 8th March, 1828; found on the shore of the West Caycos, in lat. 21° 40′, lon. 72° 30′, 19th May, 1829.

CENTRAL DRIFT to the VIRGIN ISLES.—A bottle from the *Emerald*, Captain Nockells, bound to Jamaica, 17th December, 1831, in lat. 36° 40′, lon., by chron., 12° 32′. Found on the North side of Anegada, 8th January, 1833. The winds for the last three days, previous to the 17th of December, were from North and N.W. to S.W. For eight days preceding these it blew a continued and heavy gale from S.W. and W.N.W.; the bark lying-to the whole time, and drifting from lat. 41° 28′, 227 miles to the northward.

A bottle from the ship *Isabella*, of Leith, 2nd April, 1835, in lat. 23° 19′ N., lon. 37° 50′ W. Having lost the N.E. trade in the morning. Wind then E.S.E. Found by Cooper's Island, near Tortola, 13th September, 1836.

BETWEEN CAPE VERDE ISLES and NORTHERN ANTILLAS.—A bottle from the ship *Mary*, Captain Abyah Locke, from Otaheite to London, 16th March, 1832, in lat. 14° 48′ N., lon., by chron., 32° 25′. Found on the eastern side of Barbuda, in the following October.

CENTRAL DRIFT to JAMAICA.—A bottle from the ship *Stratford*, of London, Captain Abyah Locke, in lat. 14° 27′, lon. 34° 22′, January 29th, 1836. Picked up at 2 miles from land, near Gallina Point, on the N.E. side of Jamaica, 2nd of November, same year.

CENTRAL DRIFT and EQUATORIAL CURRENTS.—A bottle from the ship *Gambia*, in the River Gambia, lat. 13¼° N., in the latter part of 1831. Picked up on the southern side of Virgin Gorda, lat. 18° 30′.

CENTRAL DRIFT and EQUATORIAL CURRENTS.—A bottle from the *Two Brothers*, of Baltimore, in lat. 17° N., lon. 26° W. (off St. Antonio), 21st of November, 1826. Found at Aclin's or South Crooked Island, in lat. 22° 12′ N., lon. 74° 18′, on the 8th December, 1827. Hence it appears to have drifted, in a W. by N. direction, from the vicinity of the Cape Verde Isles to the West Indies, under the influence of the Drift from the N.E. and the Equatorial Current, probably in the first instance W.S.W. and thence W.N.W.

MADEIRA to the WEST INDIES.—A bottle from the ship *Symmetry*, of Scarborough, Captain Smith, on her way from Leith to Buenos Ayres, off Madeira, 9th June, 1825. Picked up at Salt Kay, Turks' Islands, after a lapse of ten years, 9th June, 1835.

Captain W. J. Capes, in the *Lady Mackworth* (*vide* page 170), in September, 1823, from the 14th of that month to the 8th of October, pursued his direct course to Barbadoes, from lat. 24° 0′, lon. 25° 1′, his situation at noon on the 14th. He says that, from leaving the Island Ferro, we found the current setting us at the rate of from 3 to 5 miles a day westward, and generally a little southing. The weather was remarkably fine all the way to Barbadoes, and always fair, so that I never took in a royal; the log-glasses well adjusted, as well as the log-line; but, on making Barbadoes, we found the chronometer to be remarkably correct, and that the ship was 112 miles ahead of dead-reckoning.

To the south-westward of Madeira, between the island and lat. 28° 0′, lon. 18° 24′, Captain Livingston found the set to be 14° 38′ S., and 37° 51′ W., 10th and 11th April, 1826.

Proceeding south-westward, from the spot last mentioned, to lat. 14° 7′, lon. 44° 6′, in fifteen days the sets were 14′ 40″ N., 1° 11′ S.; 11′ 15″ E.; and 2° 6′ W.—Surplus effect, 56′ 20″ S., and 1° 54′ W.

7th Dec., 1810.—H.M.S. *Belvedere* sailed from Bermuda, and proceeded toward the Azores. On the 21st (fourteen days' run to the eastward), lat. observed, 36° 22′ N., lon. by account, 34° 9′ W., by lunar, 35° 5′, by chron., 35° 0′; leaving 51′ for westerly current.

To the above we shall only add that on the 25th of November, 1790, the merchant ship *Rosalia* sailed from Cadiz for Vera Cruz, having, as passengers on board, Don Josef de Espinosa and Don Ciriaco Cevallos, officers of the Spanish navy, who had two good chronometers. This ship made Cape Cabron, on the N.E. side of Hayti, after a voyage of twenty-three days, and it was then found that the currents had carried them *four degrees* to the westward of dead-reckoning; and that, consequently, the daily drift averaged about 7 miles.

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5. THE EQUATORIAL CURRENT, OR CURRENT FROM THE EQUATOR TO THE COLOMBIAN OR CARIBBEAN SEA.

The action of the S.E. trade-wind in the equatorial regions, and the apparent disposition of the waters in these regions to retire westward, which have been attributed to the rotatory motion of the earth, are considered as the causes of a current which is known to flow, during great part of the year, from the Ethiopic Ocean to the Caribbean Sea, and which has frequently carried ships considerably to the West and W.N.W. of their reckonings, when off the N.E. part of Brazil.

The Current from the Indian Ocean, setting over the Bank of Agulhas, past the Cape of Good Hope, and to the north-westward beyond St. Helena, &c., is here united with the *Equatorial Current*, which thence form one great volume or continued stream.* Of this stream the western border is controlled and variegated by the South American coast and West Indian waters, while the northern and eastern borders run to the West, North, and N.E.; in the last two directions from the Equator, in about 23° of longitude, toward Cape Verde and the Cape Verde Islands. Beyond the parallel of these islands a gentle *westerly current* marks the boundary of the Equatorial Stream on the East, and commonly pursues its course so as to form a junction with it on the West. The last effect has been noticed in the remarks on the Central Currents above.

It appears, from the description of Anegada, &c., by Mr. Schomburgk (see Note 5, page 103), that the northern border of the Equatorial Current, especially *while the sun is advancing northward*, extends itself to the northward of all the Caribbee and Virgin Islands, &c., and winds thence into the Caribbean Sea. It must thus fill, in its way in a N.W. direction, the passages between the Windward Islands; and Mr. S. has shown, from various instances, that many vessels bound to St. Thomas's and St. Martin's, and supposed to be considerably to the northward of Anegada, have, in consequence, been lost on that island. His actual experiments have also proved that the current off the North side of Anegada set at times to the W.N.W. and N.W. by N. In the waters between Virgin Gorda and Anegada the set at the time was always the same, and the rate about one mile an hour.

On the North side of the isle a great quantity of cork shavings are annually washed on shore. These appear to be brought from the coasts of Spain and Portugal, first by the southerly, and next by the central drift or westerly current, which here *unites with the Equatorial*. The extent of the northern extremity of the latter is unknown, but we conceive that it never exceeds the parallel of 20°, where it probably *brushes* the offsets of the Gulf Stream, setting easterly from the Bahamas.

The greatest number of wrecks on Anegada have occurred in the months from March to June. Vessels of large burden have usually struck on the reefs to the S.E., and smaller ones farther to the West.†

The fact that the current above described is the Equatorial Current has been corroborated by the temperature of the water; for it has been observed that, in the parallel

* For the Cape Current, as described by Major Rennell, &c., see our Sailing Directory for the Ethiopic or Southern Atlantic Ocean.

† See Journal of the Royal Geographical Society, vol. ii. p. 166.

of Barbadoes, and between the meridians of 54° and 57° (a tract of sea peculiarly noticed for its discoloured water) the temperature was from 82° to 83½° in the beginning of November; which is higher, 2° to 2½°, than on either side. At the same time a considerable current from the S.E. ran through the space which contained the warmer water; proving that it was from the southward.

With the greatest velocity of the Equatorial Current we cannot pretend to be accurately acquainted. Its general direction, when in full force, in the lower parallels, is W.N.W., and generally, it is imagined, about 1½ miles in the hour, but increasing to the westward; so that off the coast of Guyana it commonly sets at the rate of 2 or 3 miles.

Near the parallel of 15° North, the currents produced by the N.E. and S.E. trade-winds may be imagined to unite; and this united stream, being divided by the Antillas, thence passes into the Caribbean Sea.

From the mouths of the Marañon, Orinoco, and other rivers, a vast efflux of water falls into the Equatorial Sea, more particularly in the wet season: what effect this water may have on the current is not fully ascertained.* But we learn, from the *Derrotero de las Antillas*, that, "Off the coasts of Guyana there are two currents: 1st, The general or equinoctial current, and another caused by the tides; the boundary of the first is 12 leagues from shore, or in the depth of 9 fathoms of water, from which, toward the shore, that of the tide is experienced.† The ebb sets to the N.E., and the flood toward shore. In the Gulf of Paria, also, the tide influences the currents.

"In the southern straits, or channels, of the Antillas, the velocity of the current *inward* is seldom under one mile an hour; but its changes are so great, that it is impossible to point out its exact direction, or to establish any general rule for its velocity."

The Rollers, or Heavy Ground Swell, of the north-eastern portion of the Antillas, which has, from time to time, produced so much mischief, was first described by Mr. R. H. Schomburgk, as shown in the Journal of the Royal Geographic Society, 1835, and copious extracts from the same are given in the third volume of the "*Colombian Navigator*," to which the reader is referred for a more complete explication of the subject.

This phenomenon appears to be caused by the meeting and combination of the drift from the N.E., and the Equatorial Current from the S.E. or S.S.E. It rises, rages, and subsides, says Mr. Schomburgk, when the air is calm, when there has been no indication whatever of a previous gale, or even when light airs have, for a considerable period preceding, come from the southward of East. The waves approach in gentle undulations, but suddenly swell against the shore, and break with the greatest impetuosity. The rise takes place sometimes gradually, but more frequently quite unexpectedly, the waves reaching an uncommon height.

A heavy "Ground Sea" is distinguished by something grand and sublime. The sea approaches in undulating masses, which suddenly rise to large ridges, crested with foam, and form billows that burst upon the beach with the greatest impetuosity; the spray flying, where the waves dash against cliffs, often more than 100 feet high, attended with loud roarings resembling thunder, which subside into a rumbling noise, caused by the nodules and fragments of rock with which the breaker was charged when advancing, which on its retreat roll backward, and are again driven forward by the next surge. Wave then follows upon wave in quick succession, there being apparently only a short interval after the third. The sea, for many miles from shore, assumes a peculiar aspect, different tints of blue, from the lightest to the darkest, forming a strong contrast with the snowy foam of the breaking waves, when they strike against a hidden rock, or with the white line visible along the whole coast. The eastern Bahamas, the north-eastern coast of Jamaica and Hayti, but chiefly Porto Rico and the Virgin Islands, and, in a less degree, the northern Caribbee Islands, are subjected to this ground sea.

It may be considered as a rule that, whenever the wind gets to the northward of East for a day or two, there will be a *ground sea* on the northern side of the islands. The

* M. de Humboldt says, however, that the influence of the most considerable rivers of America, such as the Marañon, the Orinoco, the Magdalena, and the Mississippi, is restricted within much narrower limits than is generally thought. But see Captain Sabine's Remarks, p. 216, hereafter.

† It is considered by Captain White that this current is not formed by the tides alone, but principally by *reverberation* from the Equatorial Stream itself.—*Remarks, &c.*, p. 141.

friction of the wind on the surface of the water causes little elevations or ridges, which by continuance of the force gradually increase, chiefly when the wind sweeps over a great extent of water. Finding no resistance, and having sufficient depth to sink directly down, they proceed with the direction of the wind and remain natural waves, until they meet repercussion from dashing against the shore, when they rise to an elevation much above their natural state.

The period when the ground sea sets in is generally *October*, and it continues, though with some intermission, till April and May. The wind accompanying or preceding a ground sea is, generally, from the East of North; the winds are, therefore, propelled, more or less, in a western as well as southern direction, and the Bahamas, and even Bermuda, may escape, whilst the islands from Barbadoes to Porto Rico, but more particularly the latter and the Virgin Islands, receive its first impulse.

A southern gale will likewise produce a heavy swell on the southern side of these islands; and, during the gale of the 30th and 31st of August, 1833, this was felt with great violence on the southern shore. But, generally speaking, neither in force nor duration are these surges to be compared with those of the northern side; the group of the Virgin Islands being protected, in this direction, by the Caribbean Islands or by the Colombian coasts, and not exposed to the swell of the main ocean.

To one who crosses, during a severe ground sea, from the southern side of Tortola to the northern, where the breadth of the island is inconsiderable, the singular spectacle is afforded of the sea, which, on the southern side is perhaps "as smooth as glass," on the northern shore tossing, foaming, and roaring, as if agitated by a severe gale. The effect is most curious, and if it were not for the warning that is heard long before the cause becomes visible, one might fancy the wand of a magician in action.

The northern coast of Porto Rico is subjected to a ground sea, of scarcely less force, and which has had the same effect on its coast as that of the Virgin Isles. The "Old English Pilot" observes that the sea along the North coast of Porto Rico "beats sometimes very ragingly." The force of the waves that batter against the cliffs on which the Moro stands is amazing; and any observer will admit that the spray is sometimes carried more than 100 feet high. It has been said that, several years ago, a brig, in consequence of carelessness, here became unmanageable, and was soon dashed to pieces against the cliffs, but few of the crew escaping.

Of the currents in the vicinity of Anegada and the Virgin Islands Mr. Schomburgk says—"It is well known that the tropical current, caused by the earth's rotation, sets to the westward, and its grand movement in these latitudes is directed through the Caribbean Sea; but it is probable that a branch of it, turned aside by the north-eastern coast of South America, sweeps along the Caribbean Islands to the N.W. till it reaches the Bahamas; and it is this branch which, at present, attracts my particular attention, and in proof of the existence of which I adduce the following remarks:—

"Vessels bound from America to the West Indies, and chiefly to St. Thomas's, frequently find themselves to the North of the Virgin Islands; and this deviation from their intended course has proved but too often fatal, having brought them on the reefs of Anegada when they thought themselves far to the southward of that dangerous island. Nor can repeated occurrences like these be attributed exclusively to errors in the observations for determining the latitude, or to false reckoning."

The American brig *William and Thomas* left New York 28th of October, 1829. Made Bermuda on the seventh day after departure, when, contrary winds retarding her course, land was discovered in the morning of November 15th: according to reckoning, it was supposed to be St. Martin's; but it was fortunately known, on approaching, to be Virgin Gorda, or, probably, in the night, the vessel would have gone on the reefs of Anegada.

The English brig *Francis*, bound from Nassau, in New Providence, to Trinidad, cloudy weather having precluded an observation for several days, was supposed to be far distant from Anegada, but making land in the evening, supposed to be St. Martin's, was wrecked at eleven p.m. on the reefs of Anegada.

The American brig *Lewis*, bound from Philadelphia to St. Thomas's and Maracaybo, and supposed on the day previous to be on the parallel of St. Thomas's, was wrecked on the south-eastern reef of Anegada, 9th of April, 1831.

During his continuance at Anegada, Mr. Schomburgk acquired additional proofs of the existence of a north-westerly current. He found on the south-eastern reef several

buoys with tyer [coir?] ropes attached to them, which appeared to come from St. Martin's. On the 24th of September, 1831, after a severe gale, two buoys were found on the same reef, which had probably been attached to anchors on some ground to the S.E.

On sounding between Virgin Gorda and Anegada, Mr. Schomburgk threw the log every thirty minutes, and taking bearings of some remarkable objects, the drift was found to be always westerly: and the result appeared to be the same whether the tides set North or South. On one day he left his anchorage, and sailed 10 miles to the northward of Anegada, where the boat was lowered, and rendered stationary by means of a kettle filled with stones, it being then southern tide; in spite of which the log was carried N.W. by W. A similar experiment was made in the waters between Virgin Gorda and Anegada, with the advantage of anchoring; and the set was always the same, the drift being nearly one knot.

The north-western or ebb tide between Anegada and Tortola is much stronger than the flood to the S.E.; undoubtedly from the circumstance that tide and current work the same way.

On these circumstances Mr. Schomburgk observes, that the wind, from March to June, frequently blows from the South and S.E., and the velocity of the N.W. current will be thus increased; in consequence of which, vessels bound during that time for these islands are more subject to error in their course than at any other period; and lighter bodies being more influenced by currents than heavier ones may be taken as the specific cause of the last remark.

The following facts establish the existence of the combined currents; and they show, in some degree, the force and direction toward the Brazilian coast.

Canaries to Brazil.—In June and July, 1795, the *Bombay Castle*, East Indiaman, between the Isle of Palma (of the Canaries) and the coast of Brazil, experienced a westerly current, amounting to 4½ degrees.

On May 20, 1802, the *Cuffnels*, East Indiaman, lost the N.E. trade in 8½° N., lon. 22°. Gained the S.E. trade, June 4, in 5° N., lon. 21°. From the Equator the current was found to set West and W. by N. from 30 to 52 miles daily, till the coast of Brazil was in sight on the 14th, in 8° S.

May 23, 1802, the *Sir Edward Hughes* lost the N.E. trade in 6° N., lon. 23°, and the wind was from S.S.E. on the 25th, in 5° N., and 23° 30′ W. The trade kept far at southward, and the current set strongly to the West.

October 16, 1805, the *Europe and fleet* lost the N.E. trade in 11° N., lon. 28°, and gained the S.E. trade on the 26th, in 4° N., lon. 29°. On the 4th of November the land of Brazil was seen in lat. 6° S.; the wind near the land was at E. by S. and E.S.E. By proceeding too far to the westward, two ships of the fleet were wrecked in the morning of the 1st of November on the Roccas, or low Kays, in lat. 3° 52′ S., and 33½° W., and several others had nearly shared the same fate. This catastrophe had probably been avoided by a due knowledge of, and attention to, the effects of the current; which was subsequently ascertained to set 2½ miles per hour to the westward, near the Roccas.

On the 1st of June, 1793, the *King George*, East Indiaman, crossed the Line in 30° W., and from the 2nd to the 5th experienced a westerly current of 1° 33′. On the 5th, Cape St. Roque was in sight, and the ship was kept working until the 10th, endeavouring ineffectually to weather it; she then stood to the north-eastward, closely hauled, to latitude 1° N., in order to regain the variable winds in North latitude, and then proceeded to cross the Equator, which was, *at length*, effected.*

In May and June, 1807, the *transports, laden with ordnance stores*, for the army at Monte Video, by crossing the Equator too far to the westward, were carried so far in this direction by the current, that they could not get to the southward of Cape Augustin (lat. 8° 23′ S.), and were twice obliged to stand to the northward, into variable winds, to regain easting, after having attempted ineffectually to gain the S.E. trade-wind.

H.M.S. *Tartar*, Captain T. Brown, on returning from South America, in November, 1825, was found to be affected daily by a current between the latitudes of 0° 8′ N. and 4° 53′ N. (lon. beyond 24° 30′ W.), in a period of three days, 87 miles N. 44° 27′ W. (*true*), equal to 29 miles a day.

* In lat. 5° 6′ S., lon. 35° 43′ W., to near the coast and the meridian of 38°, the *Inconstant* frigate was carried by the current 47 miles N. 73° W. in twenty-four hours, 1st April, 1814.

It is a well-known fact that several ships have made the Isle of Fernando Noronha,* on their outward-bound passage to India, by the currents having set them to the westward, after the failure of the N.E. trade-wind. The currents run strongly about this island.

And, in 1770, a small vessel laden with corn, and bound from the Island of Lanzarote, one of the Canaries, to Santa Cruz, Teneriffe, was driven to sea, while none of the crew were on board. The motion of the waters, to the South and West, carried it to America, where it went on shore, at La Guayra, near Caraccas.

Cape Verde Islands to Hayti.—A bottle from the ship *Duke of Marlborough*, by Mr. Geo. Thom, in lat. 16° 22′ N., lon. 26° 31′ W., 14th of October, 1820. Found, 24th of July, 1821, at *Agujero Chico*, or Petit Trou, on the South coast of Hayti, and made public by Captain James Robinson, of the brig *Endeavour*, of Liverpool.

Equatorial Sea to Barbadoes.—A bottle from the *Stratford*, of London, Captain Abyah Locke, on her return from Otaheite, 21st January, 1836, in lat. 4° 7′ N., lon. 24° 17′ 15″ W. Found on the northern extremity of Barbadoes, 8th June, 1836, its direction apparently having been about W.N.W. ¾ W., *true*, and distance 2,100 miles.

By the *Jane*, Captain Livingston, toward Demerary, between lat. 14° 7′ N., lon. 44° 6′, and lat. 6° 53′, lon. 57° 18′, in six days, ending 30th April, 1826, the sets of current were 33′ 10″ N., 21′ 25″ S.; 0′ 0″ E., 3° 16′ 50″ W. *Surplus effect* (or Equatorial Current), 11′ 45″ N., and 3° 16′ 50″ W.

In November, 1825, between Maranham, on the North coast of Brazil, and lat. 6° 8′ N., lon. 47° 17′ W., Captain Livingston was set 1° 12′ 35″ N., and 1° 55′ 28″ W., *without any southerly or easterly differences.*

On proceeding toward England, in July, 1826, Captain Livingston, from Demerary to lat. 24° 55′, lon. 59° 24′, in eleven days, found the sets 1° 18′ N., 0° 0′ S.; 1° 0′ E., and 3° 7′ W. Surplus effect, 1° 18′ N., and 2° 7′ W.

Off Guana, H.M.S. *Racehorse*, Captain J. Everard Home, on the passage from Barbadoes to Para, lat. 8° 36′ N., lon. 52° W., at 1½ p.m., fresh breeze from E.N.E., found the current during the last twenty-four hours had set N. 25° W. 16 miles.

Equatorial Current to Trinidad.—A bottle (No. 267) from the *Osprey*, of Glasgow, at noon, on the 17th of January, 1822, in lat. 6° 13′ S., and lon. 15° 35′ W. Found on the 27th July, 1822, in Mayaro Bay, Island of Trinidad, lat. 10° 15′ N., and lon. 61° 2′ W.

Equatorial Current to Tobago.—A bottle from the schooner *Julia*, Wm. Davidson, master, in lat. 6° N., and lon. 40° W., Nov. 6, 1821. Found, 7th of March, 1822, near the shore of Little Rockly Bay, Tobago.

Equatorial Current to Barbadoes.—In the night of the 5th of June, 1827, during hazy weather, H.M. packet ship *Cynthia*, commanded by Lieutenant White, grounded on the reef extending from Kendal Point, on the South side of Barbadoes. Upon this reef she was driven by the current, which then ran with very unusual and extraordinary strength, and soon became a complete wreck.

In June, 1828, the ship *George*, of Bristol, bound to St. Vincent's, ran ashore near the same place, and was likewise wrecked. We attribute this to the current, as well as the wreck of the *Cora*, Captain Abbott, here lost on the 4th of September, 1826. In the last case, the wind, which had been blowing from the S.E., suddenly shifted due South, and the vessel, having previously lost her mainmast in a hurricane, was unmanageable.

The bark *John Stewart*, Rimington, master, from Demerary to London, with the wind blowing fresh from E.N.E., struck on the *Cobblers*, upon the S.E. side of Barbadoes, at five a.m., 17th January, 1834, and became a total wreck. The crew with difficulty gained the shore, and were therefore saved. We think that this may be fairly included in the losses produced by the current.

Guyana to St. Vincent's.—A bottle thrown into the sea on the 20th May, 1835, in the latitude of Demerary; picked up in Sable Bay, St. Vincent's, on the 24th of June. At the same time several large trees were washed ashore, among them a Spanish cedar, and which, from their appearance (being covered with a coat of barnacles and sea-weed), must have been a long time in the water: these were, no doubt, driven out to sea by the overflowing of the Orinoco, occasioned by the heavy rains.

* Lat. 3° 55′ S., lon. 32° 28′ W., or thereabout.

Some years back a very large cedar came on shore at Sable or Sandy Bay, bringing with it a large female *boa constrictor*, which took to the neighbouring wood, and when shot, some days after, was found to contain many young ones, nearly ready to escape; and which, but for the destruction of the old one, would have taken up their abode in the woods.

EQUATORIAL CURRENT TO MARTINIQUE.—A bottle from the ship *Osprey*, of Glasgow, lat. 5° 12′ S., lon. 24° 40′ W., 28th March, 1820. Found, 4th of February, 1821, near the eastern point of the Salines, quarter of St. Anne, Island of Martinique. Attested at St. Pierre, Martinique, 13th of February, 1821, by Monsieur T. Bournant, Printer, and Director of the General Post Office at that place.

A bottle thrown from the *Osprey* at noon, on the 1st of April, 1820, in lat. 12° 56′ S., lon. 29° 10′ W., was found, 10th of June, 1820, on the Barra Grande, coast of Brazil, latitude about 9° 20′ S. Its true direction seems to have been N.W. by W. ¼ W. Attested by Messrs. Lowe and Co., of Maçaio, in the province of Pernambuco.

CAPE VERDE ISLES TO BRAZIL.—The *Hazard*, of Greenock, August 4th, 1812, lost the N.E. trade, in lat. 11° N., lon. 25° W.; and the wind, until the 12th, varied from West to S.W.; from the 12th to the 17th it generally blew from South, never exceeding one point easterly. Gained the S.E. trade on the 17th, in lat. 2° N., lon. 27° 30′ W.; the trade kept southward between Penedo de S. Pedro, or St. Paul's Islets, and the coast of Brazil (at Rio Doce), and experienced a westerly current amounting to nearly *four degrees*. Attested by Captain J. W. Monteath.

BETWEEN MADEIRA AND BRAZIL.—In the *Jane*, Captain Livingston, April and May, 1824, found a surplus effect of currents, between Madeira and Brasilian Trinidad in thirty-nine days, equal to 1° 19′ 47″ S., and 6° 3′ W.

Finally, Captain Sabine has shown, that in 1822, after H.M.S. *Pheasant* sailed from Maranham, she entered the current, the full strength of which she had quitted to go to that place, and it was then found to be running with the astonishing rapidity of 99 miles in twenty-four hours. On the 10th of September, at ten a.m., while proceeding in the full strength of the current, exceeding 4 knots an hour, a sudden and very great discolouration of the water ahead was announced from the mast-head; the ship being then in 5° 8′ N., and 50° 28′ W. (both by observation), it was evident, that the discoloured water could be no other than the stream of the Marañon, pursuing its original impulse at no less than 300 miles from the mouth of the river, its waters not being yet mingled with the *blue* waters of the ocean, of greater specific gravity, on the surface of which it had pursued its course. It was running about 68 miles in thirty-four hours.

Thus, as the Baron de Humboldt says,—"The discovery of a group of uninhabited islands is less interesting than the knowledge of those laws which link together a considerable number of insulated facts."

It has been shown in our volume on the *Southern Ocean*, that, on the eastern coast of Brazil, between the months of September and March, the winds more commonly prevalent are from N. by E. to N.E. by E.; between March and September, the prevailing winds are chiefly from E. by N. to E.S.S.

The former of these is generally termed the NORTHERLY MONSOON, and the latter the *Southerly* one; although there appears, in fact, to be no direct and opposite change in them on or about the equinoxes, as is generally the case with the winds so called, these winds being simply a continuation of the S.E. trade, *which changes its direction* as above described, and as influenced by the land on its approach thereto.

Under the operation of the winds, and according to their changes, the currents must, consequently, vary; and a reasonable allowance for them will be made, according to the judgment of the navigator.*

From the month of March to that of September it may be presumed that they set most to the northward; on the contrary, between September and March, more to the southward.

There can scarcely be a doubt, that with change of season, there is a considerable variation in the course and breadth of the Equatorial Current. Northerly winds may

* See further, as to those on the coast of Brazil, and between Brazil and Guinea, *The Sailing Directory for the Ethiopic Ocean*.

press it toward the shore of Guyana, &c., and other circumstances disperse it over the ocean to the eastward. Of such variations a singular instance has been related in the Spanish *Dorretero*, which appears quite contrary to preceding experience; but it is given on the most respectable authority, and is, therefore, subjoined.

EASTERN BRANCH OF THE EQUATORIAL CURRENT.

In no part of the ocean, perhaps, have mariners been more at a loss, in accounting for the current, than in that near the Equator, between the meridians of 25° and 40° W.; not being aware of the powerful effect of the African S.W. monsoon, &c. (noticed in page 207), and which prevails from the beginning of June to October. The effect of this, and the change of season, is to divert a great portion of the Equatorial Stream to the North, N.N.E. and N.E., even to and beyond the Cape Verde Isles.*

By actual trial and much trouble, Captain Cheveley, of Liverpool, in June, 1830, found the hourly drift between Cape Verde Islands and the Line as follow:—

Lat. 9° N., lon. 33° W., N.N.W. 1 mile; lat. 7° N., lon. 31° N., three-quarters of a mile; lat. 6° N., lon. 33°, N.N.E., half a mile; on the Equator, near lon. 40°, strong N.N.E., 1¼ miles; but on rounding Cape St. Roque, in about 5° S., the current was found setting *westward*, 3 miles an hour.

And, even to the N.W. of the Cape Verde Isles, between lats. 23° and 20°, lons. 23°, 24°, Captain Cheveley had found a current to the N.E. of one mile an hour; and in lat. 18°, lon. 25°, it was found in the same direction, 1¼ miles. To the westward and S.W. of the isles, in lat. 14°, lon. 26°, N.N.E. half a mile.

It will probably be found, at a future time, that the current changes more regularly than is commonly supposed, and a further investigation of it is certainly among the desiderata of navigation.

Major Rennell has said—"Experience most fully proves, that although nature effects all her operations in such a manner as that, ultimately, the whole system is balanced and preserved, yet that, in detail, she often appears irregular, according to our limited comprehension. The trade-winds and the currents of the ocean partake of these irregularities, although the general system is upheld. The trade-winds in the Atlantic are often unsteady, even to 5° or 6° within their northern boundary; and instead of N.E. winds, there are found N.W., and even S.W. winds, for many days consecutively; and this state of things prevents the *drift* current from being so regular there, as in the heart of the trades.

"Anomalies also take place in the great Equatorial Current, and in that of the S.E. trade. The former has been known, at one time, to run to the eastward, or directly opposite to its general, and as is commonly understood, perpetual course; and at about the same rate, and with it, the whole mass of water from 5° N. to 12° S. At another time, a like anomaly took place between the parallels of 2° N. and 7° S. This latter was *observed to take place* at 6° or 7° to the eastward of Cape St. Roque; but the other about midway between the two continents. In a third case, nearly in the middle, the current *ceased altogether;* or rather there was neither an easterly nor a westerly current. This happened in February; the other two in July and August."—(Pp. 66, 67.)

* The American exploring squadron, which left Madeira on the 25th of *September*, 1838, after passing the parallel of the Canary Islands, experienced a north-easterly current of about half a mile an hour, where a current in a south-westerly direction is generally supposed to prevail; this continued until they reached the latitude of Bonavista. Captain Wilkes says:—"We hove-to and tried the current morning and evening, and always found the same result." The current log used, was two kegs, with a distance-line of 5 fathoms between them, the lower one being just loaded sufficiently to sink the air-tight one under the surface of the water, with the usual log-line attached to the centre of the distance-line, precluding the possibility of its being a surface current: besides which, the dead-reckoning of the ship, and our observations, gave the same result.

On the 29th of September the squadron passed into coloured water, quite as green in appearance as that of 50 fathoms in depth on soundings. On entering it, the temperature decreased 1½°, and rose 2° on leaving it. The vessels continued in it until the 2nd of October, having then run a distance of 450 miles. They repeatedly sounded with from 100 to 300 fathoms of line, but no bottom was found.—*Athenæum, 21st Sept.*, 1839.

The instance before alluded to, as given in the Spanish *Derrotero*, is as follows:—

The deceased Admiral Don *Cosmé de Cherruca* (as before mentioned, page 199) sailed from Cadiz on the 15th *June*, 1792, for the purpose of surveying the West India Islands and Spanish Main. On the 6th July he crossed the Tropic of Cancer in 28° 56′ West of Greenwich, without having discovered any error in the dead reckoning; neither did they find any on the 8th: the trade-wind was then fresh, and it was remarked that it attained the greatest strength when the sun was on the meridian, by night as well as by day. This phenomenon, which continued during the subsequent days, is precisely contrary to what had been observed when the sun was to the southward of their zenith; and the writer observes, "According to the general theory of the winds, it appears that the breeze ought to freshen when the sun passes the meridian, in all cases except when the declination is equal to the latitude in which the observer is placed. It is desirable that all navigators should note in their journals the times and circumstances under which they experience the greatest and least force of these general winds; for such observations, frequently repeated, might furnish knowledge, which is a *desideratum*.*

"On the 10th of July they found a current of 1$\frac{1}{10}$ miles per hour, setting N. 49° E., reckoned for two days: care had been taken to heave the log very frequently, and always on any alteration of the sail carried. Their course was S. 64° W. From the 10th to the 12th they also found a current setting N. 31$\frac{2}{3}$° E., nearly a mile an hour; from noon of the 12th to noon of the 14th the current had carried the vessel to the N.E. 44½ miles out of her course; and at noon of the 15th, 17 miles N. 21° W.

"At noon of the 17th they found that in the preceding forty-eight hours the vessel had been carried 43 miles to the N.E. of her reckoning. On the 18th, in the evening, they saw the Island Tobago bearing S. 55° W. By making this island, they found that the reckoning by account was 2° 13′ 45″ *ahead* of the ship; equal, in this parallel, to 43$\frac{1}{3}$ leagues: and Don Cosmé thereupon made the following reflections:—

"In ten days, between the parallels of 21° 45′ and 11° 44′, and the meridians (West of Greenwich) of 33° 30′ and 59° 50′, the vessel was set 2° 48′ 27″ to the North, and 2° 27′ 45″ to the East, of dead-reckoning, or 71½ leagues, as if they had experienced a daily current of 21$\frac{1}{3}$ miles, setting N. 38° E. This great error cannot be attributed to any carelessness in making up the dead-reckoning, nor to its insufficiency, for it is known that a log-line marked to 50$\frac{2}{3}$ English feet, between knot and knot, ought not to measure distances greater than those sailed: and, consequently, it must be concluded that they had a constant and powerful current setting them to the N.E.

"There can be no doubt, Don Cosmé says, of the existence of a current to the westward in the tropical zone: the action of the moon must necessarily produce it; and the experience of navigators, who have generally found their vessels ahead of their dead-reckoning on making the coast of America. The constant action of the trade-wind must also co-operate, and it would be temerity to oppose an opinion so satisfactorily established, and so generally adopted. My own observations are, however, certain; my dead-reckoning was most circumspectly and prolixly made up, and there can be no possibility of a doubt that we experienced a current to the N.E. The thing is certain; and now let us try to reconcile these circumstances, which appear so contradictory.

"From the month of May till November the rains are continual and copious on the continent and islands of America; in consequence of which the rivers ought to be increased, not only in size, but in velocity of movement. The number of these rivers is very great, and their united action must be very considerable on the waters of the ocean: and it may be the mean of destroying the Equatorial Current, and of making one in a different direction. On the one hand, as the rainy season is also the season of the hurricanes, and that in which least navigation is carried on, the currents during that period have been less particularly (or more seldom) examined; and consequently little is known of the currents produced by the rivers; while, on the other side, as the principal navigation is made in the months which have no rain, and in which the rivers have no considerable force sufficient to destroy the Equatorial Current, it follows that the majority of navigators find currents setting westward.

"Should the foregoing reasons prove correct, it will follow that from November till March currents may be found setting to the westward, and during the other months of the year to the north-eastward."

* Upon this subject see the Observations upon the Winds.

It may be seen, by reference to our next division, on the Currents of the Caribbean Sea, &c., that this idea of the Spanish commander is not merely chimerical. For it is shown that during the *rainy* season the current on the Colombian shores often sets to the eastward; thus uniting with the Equatorial Current, and forming an outset from the Caribbean Sea. There may probably be, at all times, a southerly re-flow on shore.

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6. THE CURRENTS OF THE COLOMBIAN OR CARIBBEAN SEA, AND THE MEXICAN STREAM.

"On the Colombian coast, from Trinidad to Cape la Vela, the current sweeps the frontier islands, inclining something to the South, according to the straits which it comes from, and running about 1½ miles an hour, with little difference. Between the islands and the coast, and particularly in the proximity of the latter, it has been remarked that the current at times runs to the West, and at others to the East. From Cape la Vela the principal part of the current runs W.N.W.; and, as it spreads, its velocity diminishes: there is, however, a branch, which runs with the velocity of about a mile an hour, directing itself toward the coast about Cartagena. From this point, and in the space of sea comprehended between 14° of latitude and the coast, it has, however, been observed, that, in the dry season, the current runs to the westward, and in the season of the rains, to the eastward.

"On the Mosquito shore, and in the Bay of Honduras, no rule can be given for the alterations of the current. All that can be said is, at a good distance from land, it has generally been found setting toward the N.W.

"In crossing from the coast, or from Cartagena, to the islands, it has been discovered that from La Guayra to the eastern part of Hayti, on a voyage made in December, a difference of 106 miles to the westward was found during the seven days the voyage lasted."—*Derrotero de las Antillas.*

The Baron Alexander von Humboldt, in describing his passage from Cumana, westward, to La Guayra, has said—"The general motion of the waters between the tropics toward the West is felt strongly on the coast during two-thirds of the year only. In the months of September, October, and November, the current often flows toward the *East*, for fifteen or twenty days in succession. Vessels on their way from La Guayra to Porto Cabello have been known to be unable to stem the current that runs from West to East, although they had the wind astern. The cause of these anomalies is not yet discovered. The pilots think that they are the effect of some gales of wind from the N.W. in the Gulf of Mexico; yet these gales are much more violent in spring than in autumn. It is also remarkable, that the current to the East precedes the change of the wind. It begins to be felt, at first, during a calm; and after some days the wind itself follows the current, and becomes fixed in the West."—*Personal Narrative*, Vol. iii. p. 378.

Captain C. S. Cochrane, R.N., in his *Journal*, 16th March, 1823, says—"In the afternoon we perceived high land through the haze, and hauled up for it, wishing to make a point about 50 miles to the windward of Santa Marta: but, on getting in-shore, we found that we were 7 miles to the *leeward* of that place, the current from the eastward having been running for the last twenty-four hours upward of 2½ knots an hour; which agrees with Baron Humboldt's account, that the current runs from 1½ to 4 knots an hour, according to the force of the wind and season of the year. The natives say, that the moon likewise has a considerable effect on this current, which, at the changes of new and full, runs to the *eastward* for 24 hours.

"Here I must caution all captains of ships navigating on this line of coast to allow for the current, in general, at least 1½ knots per hour, on an average, with an increase in proportion to the strength of the breeze, and an abatement at the new and full moons; otherwise vessels heavily laden, overshooting their ports, may lose as much as three weeks by having to stand away nearly to the Antillas before they can get sufficiently to windward to gain the port they have missed; and even men-of-war run a risk of carrying away spars and masts in beating up."—Vol. i. p. 52.

In the third volume of the *Colombian Navigator*, 1839, may be found, "Remarks on the Currents of the Atlantic and West Indies, made by Lieut. A. H. *Bisschop Greevelink*, in the *Echo*, a brig of the Dutch Royal Navy, during four years of service, 1833—1837," and which describe the route of that vessel from England to Surinam, in August and

September, 1833. On the evening of the 13th of the latter month, the *Echo*, having arrived in lat. 17° N., and lon. 35° W., lost the trade-wind, and the wind then shifted to the N.W., with a strong breeze, gloomy weather, and much rain, during the twenty-four hours. The following day the wind, diminishing, passed to the S.W. and S.S.E., and terminated in a calm; currents weak and variable to the S.W. and eastward.

On the morning of the 16th, in lat. 14° 40′, and lon. 36° 20′, a light breeze sprung up from the S.E., and from that time till we reached the coast we had to struggle with a never-ceasing variety of wind and weather, continual rains with squalls, and scarce a day passing without lightning in one or other quarter of the horizon. On the 18th we passed by several ripplings or eddies, being then in lat. 12°, and lon. 39° 30′ W. They usually stretched from East to West, and were often seen to cover the whole surface, everywhere boiling and bubbling as in a cauldron. Current always weak, and during the last forty-eight hours to the West and W.N.W. at a rate of half a mile an hour.

After losing the trade-wind we had to creep over more than 900 miles, as the wind had left us, in every appearance, for ever: the rains were copious and continual in this space, and lightning was seen very frequently. On the 18th (lat. 11° 52′, lon. 39° 25′), we passed through a number of eddies; and on the 24th (lat. 8° 3′, lon. 45° 37′), the first indication of a change in the colour of the sea became visible; yet it was slight, and may be attributed to a branch of the northerly current observed in the succeeding day. On the 27th (lat. 5° 52′, lon. 48° 38′), we received a gentle S.E. breeze, which brought us, though slowly, toward the coast. In the night of the 28th (lat. 5° 7′, lon. 49° 56′), we crossed the edge of meeting currents from the Ethiopic Ocean and Brazilian shore and from the Marañon; after which we entered the boundary of the tides. In the evening of September 30, came to anchor in 5½ fathoms. In the night observed longitude by chronometer, 54° 11′ 45″.

Although we had not seen land since we lost sight of the Lizard, by which to examine our timekeepers, I felt not the least doubt about their rate (the one a *Knebel* and the other a *Parkinson* and *Frodsham*), by their reciprocal conformity, corroborated by my lunar observations (which, by-the-bye, I think are never to be neglected); and as I was desirous to obtain some observations about the currents, so peculiarly remarkable in these seas, I took every opportunity, which circumstances allowed, to satisfy my curiosity on this subject.

On the 22nd of September and subsequent days the ripplings became less in number; and on the 24th, in the afternoon, about the 8th degree of latitude and 46th of longitude, we perceived the first change in the colour of the water from the common blue to a somewhat darker hue, and, as this was a somewhat uncommon case, I attributed it to a branch of current observed the following day at noon, setting due North, at the rate of more than a mile an hour, straight across a south-easterly current observed during the preceding days, mingling the muddy waters of the Marañon and other rivers with those of the ocean. From the 24th till the 28th nothing particular occurred; we were always steering to the S.W. with light, variable winds, and a continuance of rain sufficient to penetrate our very bones. Currents weak and changeable, being lastly observed to have run N. by W. 18 miles in twenty-four hours. This at present I call weak, being afterward accustomed to fall in with a velocity of twice and thrice that number of miles. At noon we altered our course to W.S.W., being then in lat. 5° 7′, and lon. 49° 55′ 55″.

In the night, however, having a lunar altitude, we were not a little surprised at finding the ship thrown 35 miles to the northward of her supposed situation, although I may say to have been prepared for this occurrence by Capt. Edw. Sabine's relation in the *Memoir*, whose track we were crossing just then, in the same month.

At break of day we saw the water totally altered in colour, and thickly mingled with mud, as if we were sailing in a flood of ochre; hove the lead, and found 45 fathoms, fine sand, white and black. At seven in the morning, by chronometric observations, I found the westerly offset 33′ 38″; and finally, at noon, in lat. 5° 21′ 49″, lon. 51° 46′ 15″, it appeared evident that the current, in the last twenty-four hours, had been running with the rapidity of 67 miles to the N. 30° W. In the afternoon we perceived the land toward the S.W. by S., being the *Family Islands* of Cayenne, and at the same time we entered the boundary of the tides.

This, indeed, seems to confirm the opinion of those seamen who attribute the principal strength of currents hereabout to the waters of the Marañon, &c., predominating over those of the ocean; but this is to be admitted in a partial degree only; for, as operating on the general direction of the Equatorial Current, I esteem it as of no influence at all.

The numerous voyages made by the *Echo* in the West Indian Seas, with a particular detail of each, more especially in regard to the currents, are given in the volume above mentioned; and from these voyages and experiments the general inductions are, that between the Caribbee Islands and the coast of Guyana, in the months of August, September, and October, the current veered to the northward of North-west, and in other months more westerly, or even to the southward of West, as in November and December, 1834; but we learn, also, that the greatest velocity of current has been observed in August and September, when the Marañon is at its lowest level, as well as in December and March, when this river begins to increase and attains its greatest height: even on examining the details, in order to discover any regularity in its force, we find an irregularity reconcileable only with that of the wind; and, more generally, by applying the theory of trade-winds, and their influence upon the surface water of the ocean.

After having once rebounded from the Brazilian coast, the united Equatorial and Ethiopic Currents are again compelled to retire westward by influence of the S.E. trade-wind (apparently, also, by the disposition of the waters in these regions to retire westward); and, although at passing the Marañon, which disembogues toward the N.E., the combined current, may, in some degree, and according to its variable form and strength, derive an impulse to the northward, yet it soon yields to the force of the N.E. trade-wind, and the south-westerly drift thereby produced, which sets toward the Caribbee Islands.

In proportion to the force and extent of these winds, the general current is pressed toward the shore of Guyana, as in December, 1835, and November and December, 1834; or allowed to expand freely to the North, as in August, September, and October; yea, even to the N.E., as in March, 1837, especially when preceded by long and violent indraughts, and followed by calm weather.

By influence of the Marañon waters, the general current is prevented from sweeping the coast to the westward of Cape North; as the stream of this great river, being unobstructed, seems to gather all its strength, and force the western boundary of that gigantic drift to an uncertain distance from shore. In this manner we may account for the weak westerly current, creeping along that part of the coast comprehended between the Marañon and Gulf of Paria, called the *region of the tides*, and which is produced by the remaining effluxion of the Marañon, confined between the western border of the general current and the muddy banks of Guyana. It is incorrect to fix this border in 9 fathoms of water, as I have found it in twice and thrice that depth; but on the other hand, I think that, if what has been supposed by Admiral *Don Cosmé de Churruca* should ever again happen,—I mean the destroying of the Equatorial Current by the action of the rivers—the Atlantic will be found of a whitish hue, so far as these currents shall reach, because their thick muddy waters never mingle with those of the ocean until they have been subdued by, and are at rest with, them.

The direction of currents in the Atlantic is reconcileable with the force and direction of the trade-wind, but not without exceptions; because the height of the water-level in the Caribbean Sea will sometimes baffle every calculation both within and without the range of islands, as shown indubitably by experiments founded, not only upon the method of ascertaining currents at sea, but also within sight of land, and observations made on shore along the coasts. It has also been found that during calm weather, even with strong easterly winds, the currents have sometimes been running for days together to the eastward, especially in the latter parts of January and July, when, by the then prevailing strong winds, the water is heaped up in a very uncommon degree, and the inner part of the Caribbean Sea, most probably overcharged, succeeds in re-establishing its equilibrium by forsaking the power of its wrathful driver. In this manner, I think, we ought to reconcile those circumstances mentioned by that illustrious Spanish commander.

In the Caribbean Sea the force and direction of currents are more distinctly modified by the direction of the wind. With continual light winds and smooth water the currents are generally weak, augmenting only in proportion to the increasing wind; this may serve as a proof that, among other less perceptible causes, under which they are governed here, wind is the most powerful agent; for the indraught through the channels appears plainly to proceed from the force and extent of the trade-winds. In this sea, from the Windward Islands westward, to 72° of longitude, the general direction of currents, observed during our four years' cruise, was N.W. and westerly; the weakest in October, November, April, and May; the strongest in December, January, February, and March, along the coast of Venezuela, and in July and August in the northern parts; but, in

general, so much always depended on the force of the wind, that, with few exceptions, *almost every voyage was affected by a force of current corresponding to that of the prevailing wind.*

EXTRACTS FROM THE JOURNALS OF LIEUTENANT GREEVELINK.

"*In January*, 1834, the *Echo*, in crossing the Caribbean Sea, from Curaçao to windward, experienced a drift of 40 miles to the West, and escaped only by running straight for the coast of Hayti, beating to windward along that and the coast of Porto Rico, with the best success, and even assisted by weak easterly currents when near the shore. Wind from the E.N.E., sometimes blowing a gale; but, when sheltered by the land, the water was tolerably smooth.

"*In December*, 1835, the *Echo*, then on her passage from Surinam to Curaçao, with sharp breezes, found the current sweeping through the channel between Tobago and Granada, and farther on, along the Leeward Islands, with a velocity of more than 2 miles an hour to the W. by N.; but in October, 1836, on the same route, with light winds and calms, the water ran for days together to the northward, at the rate of only half a mile an hour.

"*In March*, 1836, the same vessel, from Curaçao to La Guayra with very strong winds, spent six days in beating up against a current of 40 miles mean daily strength; and on the 8th of April left La Guayra for Porto Cabello, in the bight to the westward, when, instead of making this passage in some hours, she had, during three days, to contend with light, variable, and even westerly winds, and currents to the N.E. 15 miles daily.

"The Baron von Humboldt's remark about the increase of the currents near the Testigos proved true on our approach to the same islands, in December, 1835.* In the morning of the 12th, the longitude observed was 62° 45′ 15″, and the difference West in twenty-four hours appeared to be 32′ 15″; shortly after, that cluster of rocks came in sight; and at noon, at the very moment that the sun passed the meridian, the S.W. island, placed by Don J. F. Fidalgo in 63° 12′, bore East, distance one mile, having run by log 20 miles to the W. ¾ N.: so that, during these last four hours, the westerly difference amounted to 8 miles, whereas, in former watches, it was only 5¼ miles.

"A similar circumstance, we have reason to believe, also takes place at other groups of this range of sunken islands, and near such capes as are low and reaching far out, so as to obstruct the motion of the water beneath, and thereby redouble the force of the surface current; as denoted by the many instances of shipwreck and carcases of vessels (sad admonishers of precaution) spread among these flat, barren rocks, and produced solely by the irregularity of currents, which baffle every calculation, even those of the coast traders.

"But this variety in the westerly currents here is not the only cause of danger. The total change in the setting of the currents from West to East is of a nature which requires the utmost care and attention, as they not only occasionally happen with calms, but also sometimes with fresh breezes from the eastward. One of the first-mentioned instances, particularly remarkable, we observed during our passage, in October, from Surinam, through the Channel of Granada, toward Curaçao. On the 7th and 8th, between the Island of Tobago and Cape Malapasqua, the water flowed to the *N. by E.* and *N. by W.*, with a trifling force; when suddenly, on the 9th, we had a difference of 17′ 54″ North, and 34′ *West;* and on the following day, at the *new moon*, we were driven 11′ 12″ to the North, and 35′ 54″ to the *eastward* of our supposed situation. This case was too singular not to excite our attention, as the high mountains of Caracas showed us almost hourly the East or westerly direction in which we were driven; the weather being perfectly calm, and the water constantly smooth, by which means we were able to verify our chronometrical observations, and to remove every doubt respecting the truth of so extraordinary a circumstance, the result whereof was as follows:—

"By the westerly current we drifted in sight of the high land near *La Guayra*, and kept working up against the strong easterly set in the whole following day. On the 10th, from seven in the morning till four in the afternoon, we had 14 miles difference West, agreeing with the bearing of *Monte Avila*. From that time till six in the evening, when

* The remark is as follows. The Baron, on approaching the Testigos, 14th July, 1799, says—"During a calm, the current drew us on rapidly toward the West. Its velocity was 3 miles an hour, and increased as we approached the meridian of the Testigos, a heap of rocks, *which rise up amid* the waters."

that mountain, of which we had lost sight for a moment by drifting to the westward, again became visible, the water flowed again to the eastward; and on the 11th, at six in the morning, with an observed latitude, and the said mountain bearing S.E. by S., we were in lon. 67° 21′; and this by calculation being 67° 47′, we found a difference of 26 miles to the eastward in sixteen hours. From this time till four in the afternoon, again 10 miles to the West; and from thence until the following morning, 22 miles easterly difference. During the night we hove-to, to the southward of Caracas Bay, Curaçao, and were obliged to keep *Little Curaçao* in mind, as the current was setting strongly to the eastward.

"Whether this flux and reflux were caused by the moon (then new), or by any other agent, I shall not attempt to determine. Indisputably there occasionally appear satisfactory reasons for ascribing to that luminary some influence over the currents in these regions, and the above-mentioned case is probably one of them; but, as Captain Livingston says on the subject, 'the winds have a still more powerful influence.' Indeed, when roving in these seas, studying the *Memoir* and the *Columbian Navigator*, and enjoying the pleasure of reading all that science and skill have ever produced in the description of these regions, we always meet with Captain Livingston's remarks as so many illustrations, and feel a continued increase of respect for so accomplished a navigator.

"The reflux of the current to the eastward, for some hours daily, we had also occasion to observe, in January, 1834, near the coast of Hayti, Porto Rico, and even in the Atlantic, while working up with smart breezes, and even with very strong winds; and once, in May, 1835, a merchant-vessel, steering for Curaçao, with her mainmast broken, passed in the night to the southward of Buen-ayre and Little Curaçao, without seeing the land, being totally unacquainted with any existing current, and consequently with her real situation. At daybreak, finding herself opposite the eastern part of Curaçao, and supposing it to be the Island of Buen-ayre, she stood to the West for Curaçao, as she thought; but on her passing the harbour of St. Anna, she guessed her error, and tried to gain the entrance, in which she succeeded toward sunset, after hard struggling with a strong wind and a rough sea, but assisted by a current to the *eastward.*

"It should be borne in mind that the captain of this vessel was unprovided with a time-keeper, from want of which he knew nothing about easterly or westerly currents; and if, on his approaching Buen-ayre, he had accidentally stood a few miles to the N.W., so as to make its northern coast, he would have found a watery grave, designated, perhaps, only by some piece of floating timber, a splinter, or broken spar.

"The uninterrupted easterly currents, alluded to, have already been mentioned by Baron A. von Humboldt; and whenever I witnessed them, I found them just as described by that celebrated traveller. It may, however, be remarked that although this change in the general motion of the water is most common in the three months quoted, and chiefly along the Colombian coast, yet sometimes it also happens in other months, and in other parts of the Caribbean Sea; as we, in fact, once experienced it in December, once in April, near the coast above-mentioned, and once in March, on our passage from Guadaloupe to Barbadoes, during which vessels from St. Vincent's made their way toward the same islands in a few hours."

Further Description, from the Journals of British Navigators.

Mr. Town, in his "Directions for the Colombian Coast,"* has said "Although between the Island of Jamaica and the Spanish Main westerly currents are most frequent, yet they do not always prevail; for ships have been known to be driven by the current from 50 to 60 miles to the *eastward*, in four or five days. From the beginning of May till November (*the rainy season*) the sea-breeze seldom or never blows home to the main: and ships going there should never go to the southward of the latitude of 11°, until they are at least 40 or 50 miles to the westward of their intended port; after which they may make a South course, as the land-breeze, which is generally from the S.W., and the strong *easterly* current, will set you to the eastward of your intended port, if great care be not taken. When to the eastward, if light winds prevail, you must stand to the northward until you meet the sea-breeze, which will be between the latitudes of 10° and 11°, and then run to the westward.

* See the *Colombian Navigator*, vol. iii. p. 231.

"Being off Porto Bello, in H.M.S. *Salisbury*, on or about the 12th of August, 1816, and being a little to the eastward of that port, with light variable winds for several days, the ship was to the *eastward*, at the rate of 30 miles per day; and, having been afterwards placed in the same situation, I found it necessary to make the land well to the westward, and to keep close to it. From November until May (the *dry season*) you should endeavour to make the land well to the eastward, and run along shore; as the sea breezes generally blow very strongly, and the current sets to the westward at the rate of about 2 or 3 miles an hour.

"Between Chagre and Porto Bello, during the rainy season, there is generally a northerly current, at the rate of from 1½ to 2½ miles an hour. After the end of the rainy season the current sets to the southward and westward, and strong southerly and easterly winds prevail here. From November until May (the *dry season*) the southerly and westerly are very light winds, except in squalls, which end with heavy rain. In sudden squalls you will often have the wind from all points of the compass.

"If at Chagre at any time during the rainy season (May till November), and bound to the eastward, endeavour to get 4 or 5 leagues from the land so soon as you can; for the winds are, in general, very light, and the current very strong. The latter sets from Chagre directly on the rocks of Porto Bello, and thence along the land from E. by N., E.N.E., E.S.E., and according as the land lies; its general rate being from 1½ to 2½ miles in an hour. Great care should be taken when near the land, if a heavy squall and rain appear to be coming on. During this you will have the wind from all points of the compass, and often so strong that all sail must be taken in.

"In crossing the Gulf of Darien, little or no current will be found: whenever there is any, it sets about South, S. by W., or S. by E., up the gulf.

"Near Cartagena the current generally goes with the wind; but off the Islands of Rosarito it sets to the N.W. and N.N.W., from 1 to 2 miles an hour.

"Between Cartagena and the Magdalena, in the rainy season, you cannot put any dependence on the winds or currents; but, from November to May, the trade-wind blows home.

"I should recommend, if turning to windward, with strong trade-winds, to keep the shore close-to; whereas, by going off from the land, you will not only have a heavy sea, but also a strong N.W. current. If you have light variable winds, approach no nearer to the land than 4 or 5 leagues, as you may be certain of an easterly current."

Captain Livingston says,—"During five weeks in which I remained at *Cartagena*, in June and July, 1817, the current in-shore set constantly and strongly to the northward, at a rate, I am convinced, of not less than 1½ miles an hour, or nearly as strong as the Mississippi at New Orleans: I have seen the *Esk* sloop of war, current-rode against a very fresh sea-breeze, when at anchor, nearly West from the city, distant about a mile."

Upon the CURRENT between the GRAND CAYMAN and CAPE ANTONIO, Captain Monteath has said—"In the months of May, 1814 and 1815 (two voyages in which I was chief mate of the ship *Prince Regent*, from Kingston); in June, 1817, in the ship *Fame*; and in April and December, 1820, in the ship *Mary*, between Grand Cayman Island and Cape Antonio, I invariably found the current setting strong to the eastward, or E.S.E; and I have heard it generally remarked that vessels shaping a course from the Caymans for Cape Antonio have found themselves off, or even to the eastward of, Cape Corrientes: this has, in the above cases, invariably happened to myself."

Farther on, "In my passage from Kingston toward Campeché, in the ship *Fame*, June, 1817, between Cape Antonio and Cape Catoche, I found the current to set due *North*, 27 miles, in a run of eighteen hours."

We have already given, in a preceding page, the remarks of the Spanish navigators on the Currents of the Mosquito Shore and Bay of Honduras. We now add those of our friends Captains W. J. Capes, of London, and John Burnett, of Port Glasgow.

Captain Capes says*—"Between JAMAICA and BONACCA the current generally sets to the northward and westward. Here, in May, 1816, I was set 60 miles to the westward by the current, and found that it set rather northerly, from one quarter to half a mile an

* Captain Capes, since deceased, was one of those kind and generous individuals who delight in promoting their own happiness by contributing to that of their fellow-beings. Honoured be his memory!—J. P.

hour. Between Jamaica and Bonacca are the islands called the Swan Islands, in lat. 17° 24′, lon. 83° 52′. I would not advise any one bound to the bay to make these islands, for it cannot be of service, and the current is so very irregular about them, that the attempt serves only to bewilder the navigator; and by falling in with them in a dark night, a ship would be in danger of running on shore, as the land is very low.

"About the SOUTHERN FOUR KAYS the currents are very uncertain. I have known three ships to be lost on these kays by lying-to for the night, after they have made them; for, at all times, the currents set strongly on them: and, in two of the cases, the ships wore every two hours, with an intention to keep their station. In one voyage I took my departure from Bonacca at four p.m., with a strong breeze from the East, which continued till midnight: it then died away (no uncommon circumstance in this part), so that I did not lift the Southern Four Kays before four p.m. the next day, from the fore-yard. I then made all snug, and plied to windward, under single-reefed topsails and top-gallant-sails over them; tacked ship every three hours, during the night, and to my surprise, in the morning, we were not more than 1 or 2 miles to the windward of them: so, if I had hove the ship to, I have no doubt but she would have been driven on shore by the current.

"If a ship be lying-to, under RATTAN, it will not be amiss to try the current. It is my opinion that the current about Bonacca takes two different directions; one part setting to the N.W., and the other part branching to the S.S.W. I have found it so on several trials, which is the reason that I prefer taking a departure (for the bay) from the middle or East end of Rattan: for, if a ship take her departure from the West end, her course will be N.N.W.; but it very frequently happens that ships get down on those reefs when they take their departure from the West end. The reason is this: a ship steering N.W. from the West end has more of the current on her beam, which sweeps round the West end of Rattan very strong at times; consequently, ships that take their departure from the East or middle part do not feel so much of the current."

Captain Burnett, in his directions for sailing from the BAY of HONDURAS, says, "When the trade-wind prevails, a current, often very strong, sets down between Mauger Kay and the Northern Triangle; there, dividing itself, it sets to the southward, between Turneff and the main reef, and to the northward between the Triangle Reef and Ambergris Kay. It is most advisable, with the wind from East to E.S.E., to sail to leeward of the Triangle, as you will have a strong current in your favour so soon as you bring it to the eastward of you.

"In the channel between the Island Cosumel and the shore, the current along shore runs at the rate of nearly 2½ miles an hour, till lost in the Mexican Sea."

MEXICAN STREAM, &c.—It is, we believe, a well-established, although a disputed, fact, that there is a constant indraught on the *western* side of the CHANNEL of YUCATAN, into the Mexican Sea; and that there is commonly a reflow on the *eastern* side of the same channel, around Cape Antonio, &c.

With the former in its favour, H.M.S. *Resistance*, Captain Adam, off the Bank of Yucatan, made a course W.N.W. ½ W. nearly 80 leagues in the twenty-four hours, December 16 and 17, 1806;* and we have no doubt that many instances may be found to prove the same effect: on the Cuba side only it appears that vessels have been set to the southward; and Captain Manderson has stated, that when a strong easterly wind has been blowing between Cuba and Florida, vessels heaving-to off the South side of Cape Antonio, at about 2 leagues from shore, have, in the course of one night, been carried against a strong sea breeze, nearly as high as Cape Corrientes, being a distance of 10 leagues.†

* The northernmost part of the tract extended to 24° 50′ N., in lon. 90° 39′.

In the ship *George IV.*, 14th of March, 1824, Captain Hamlin found the inset into the Mexican Sea, along the coast of Yucatan, N.E. 42 miles in the twenty-four hours. Lat., at noon, 19° 24′, lon. 87° 7′. On the next day it set toward Campeché Bank, northerly 50 miles.

In the brig *Recovery*, 5th of September, 1822, the same commander found the current on the N.E. side of the Yucatan or Campeché Bank setting about 1½ miles to the northward. Next day, on proceeding toward the Mississippi, weather calm and very sultry, at five p.m. saw two very large waterspouts to the N.W. At half-past seven a smart squall came on suddenly. At eight cleared up; light winds with much lightning. At ten, next morning, severe squalls, which split the main top-gallant-sail and boom mainsail. Lat., at noon, 25° 42′, lon. 86° 53′.

† Our friend Captain Rowland Bourke, when once lying-to for the night off Cape Antonio, found himself next morning off Cape Corrientes.

The ship *Carshalton Park*, Captain J. Steele Park, sailed from Jamaica for London on the 20th of May, 1824. At noon on the 27th she was off the S.W. side of Cuba, in lat. 21° 26′, lon. (by chronometer and lunars) 84° 47′ W. Here was discovered a current setting to the N.W. at the rate of 2 miles an hour. At half-past seven Cape Antonio bore N.W. 5 or 6 miles. "The current to the N.W.," says Captain Park, "swept us into the Gulf of Mexico; and there we were beating about three or four days, making northing and westing in spite of our teeth. All this time the wind was easterly, and we might have cruised about there till Christmas, had the wind not got a little to the southward of East, which enabled us to get over to the N.E. side, where we found the current running directly opposite to the former," being now in the Florida Stream.

From CAPE ANTONIO the current sets, *at times*, to the E.S.E., past the Isle of Pines. Captain Livingston has informed us that, in March, 1818, he found the current between the Great Cayman and Isle of Pines to set in that direction, at the rate of fully 2½ miles in an hour, or 60 miles in the twenty-four hours. In August, 1817, he found the set nearly the same, but the current not half so strong. The *Spanish Directory* says, "From Cape de Cruz, on the South side of Cuba, it is noticed that there is a *constant current to the westward*, with some inclination to the southward or northward, and which has been known sometimes to set 20 miles in a single day." In opposition to this, the exact words of Captain Livingston are, "I have twice experienced a strong current, setting about E.S.E., between the Caymans and Isle of Pines; and on the latter of these occasions both my mate and myself separately calculated it to set about 60 miles per day, or 2½ miles per hour. This, however, I incline to think a very particular case, such as may but seldom occur. The winds at this time were light and westerly. On the other occasion, so far as I recollect, it set about 12 or 14 miles per day only. All my papers on these subjects have been lost; but the first instance was too remarkable to be forgotten."

On the northern coast of Hayti, and in the Windward Passages, there does not appear to be any general current. On the North side of Cuba the case is nearly the same; but in the channel here is a regular tide throughout the year, subject, however, to certain variations.

The currents of the Caribbean Sea appear to be varied by the influence of the moon and change of seasons, and combine, in some degree, with the tides; especially about Cuba, Jamaica, and Hayti.

Off the South side of Cuba the current has frequently been found setting to the eastward when the moon is increasing, or in her first two quarters; and thus it continues from Cape Antonio to Cape Maize. It is represented that it runs to the eastward for a fortnight, and then to the westward about the same time. Coasters from the Caymans commonly take the advantage of the easterly current for making their passages to Jamaica.

From this information we may conjecture that the current, which has been described as setting to the E.S.E. from Cape Antonio, is not *permanent*, but, at times, on the contrary, imperceptible, according to the age of the moon; and this has, we believe, been verified, in several instances, while the cause has remained unknown.

Mr. Dunsterville has said, "I am firmly established in an opinion, from twelve years' observation, that not only are the winds and weather on the West India station influenced by the changes of the moon, but the currents also; and it is frequently found that, if the waters run to the eastward, it is at the change and full of the moon."

In an old book, already noticed (*Kelly's Navigation*, vol. i., 1733), is an abstract from a journal, which contains the following passage:—"Between the West end of Hispaniola and the Island of Jamaica, if I took my departure upon a full or change of the moon, I found that I made many leagues more than I did at the quarters of the moon. At the full and change I was looking out for the land long before I saw it; and at the quarters, I was down upon it long before I looked for it. The reasons, as I found afterward, were, that the full and change made a strong windward current, and the contrary on the quarters. This has been exemplified in many instances."

On this subject Captain Livingston says, "It is a prevailing opinion with many, that the moon governs entirely the currents among the West India Islands. No doubt the moon has some effect on them, but the winds have a still more powerful influence.

"It is rarely, indeed, on the North side of the Island of Jamaica that there is a westerly

current when the North and N.W. winds prevail; the current then always, or almost always, setting to the eastward.

"On the South side of Cuba, when the wind is westerly, which it often is, you are always certain of a reflowing current round Cape Antonio. This is easily accounted for; as when the fresh trade-wind ceases, and the westerly winds set in, the barrier is, in some degree, removed, which confined the waters in the Mexican Sea, and they seek to regain their level as well by the channel of Yucatan as by the Strait of Florida."

Between the Isle of Pines and main land of Cuba is a strong north-easterly indraught, generally running from 1 to 1½ miles an hour, and which has caused the loss of many vessels on St. Philip's Kays and the dangerous bank stretching therefrom to the westward.

In the Windward Channel of Jamaica the current generally sets with the wind to leeward or S.W.; yet both here and at Jamaica it is variable. Some have affirmed that, when a current runs to leeward, on the South side of Jamaica, there is frequently one setting eastward on the North side; and, at other times, no current is to be perceived; also that, when a lee current runs on the North shore, the same circumstances may be perceived on the South shore as were before observed on the North.

But between the Mona Passage and the Caymans, South of the islands, the tendency of the currents toward shore is most commonly found to be to the north-westward.

In the Bahama Passages the currents are devious; both weather and lee-currents having been found. These, also, appear to be influenced by the tidal causes; for the tides are operative on the banks, and sometimes set strongly.

Currents in the vicinity of the Caycos.—Some years ago, a British frigate, on returning from the northward, and shaping a course for Turks' Islands Passage, made that of the Caycos, and was not undeceived until the Porpoise Head showed itself at the long reef of the N.W. point of Providence Cayco, which appeared 3 or 4 points on the starboard bow. Again, shaping a course, in hazy weather, from Inagua for Castle Isle, the South point of the Crooked Islands, she came upon the Mira-por-vos, and did not discover the error until the rocks were seen under the ship's bottom; passed to the S.W. of these kays, distant half a mile, sounded in ½9, 9, 10, ½10, and 11 fathoms, sharp coral rock. "Through a thick haze, Castle Isle was not seen. There is a rock, among the Mira-por-vos, which shows much like that of Castle Isle, and it was this rock which served to deceive the master. When this rock bears N.E. by E. ¼ E. 2 miles, only two of the kays are seen to the westward of it."

On the 13th of September, 1833, H.M.S. *Dispatch* sailed from Port Royal, Jamaica, for Barbadoes. Having cleared Morant Point, steered for Navaza; but the winds falling light during the night, the current setting to the N.W., carried the vessel well to the westward of it. The wind still continuing light, she had some difficulty in stemming the current, which makes about S.W. by W. between Cape St. Nicholas Mole and Cape Maize; and it was not until the 23rd that she weathered Tortue or Tortuga. The wind being still light and from the eastward, it was determined to make the Mariguana instead of the Turks' Islands Passage.

At daylight on the 24th saw the S.E. point of Great Inagua, bearing N.W. by N.: when first seen on this bearing, it had, on the East side, the appearance of a low flat; there being a range of hillocks on its South side, it there made like a group of small islands: the northern visible extremity terminated in a rising ground gradually sloping from its summit, which lies about one-third up the East side, or 7 miles from the S.E. point. Saw the reef on which the *Statira* was lost, in 1815. At noon, tacked in 13 fathoms, rock, about 3 miles off shore, with the S.E. point S.W., and N.E. point N. by W. Little Inagua, just visible from the topsail yards, off the N.E. point. The coast here is fringed by a line of rocks, in many places showing above the water, with a clear space of half a mile between them and the beach. At one, tacked; at four, opened the North side of Great Inagua, off the N.E. point, it bearing at the time W.S.W.; eastern extremity of Little Inagua N.N.E. At half-past five tacked, with the N.E. point of Great Inagua South; extremity of Little Inagua from N.E. by E. to W. by S. As we stood along the South side of Little Inagua to the East, it appeared fringed by a reef similar to the greater isle: the East part was quite white from the dung of birds, so as to be clearly distinguished after the other part of the island could no longer be seen.

September 25, at two a.m., tacked, and at daylight made the West or Little Cayco, N. by E. 2 miles; stood along its western side at about a mile off-shore, and found it

quite clear; off its S.W. end is an appearance of foul ground, caused by the current which sets over the bank from the eastward meeting that which sets to the S.S.W. along shore; the ripple and collection of weed from the bank gives it the appearance of a reef. At fifty minutes past two p.m. saw Mariguana, bearing N.N.W.; and at four, the breakers on the reef which extends from its eastern end. The chronometers gave the East end of the reef in 72° 36′. The reef extends at least 5 miles from the land, and terminates in a patch of rock above water, in the centre of which stands a single stone, like the broken shaft of a pillar, about 20 feet above the rest. The ground appears quite clear close to the reef, and no bottom with 50 fathoms within half a mile of its southern edge.

At half-past five p.m. tacked and stood along the South side of the reef; and at daylight on the 26th, saw the northern extremity of the Caycos, bearing S.E. by E.*

The FOLLOWING is an additional DETAIL of the best information we have been able to collect of the currents in the Caribbean and Mexican Seas, from the *Derrotero de las Antillas, &c.*

In the channel between Trinidad and Granada the current has been found to set nearly West; on the South side half a point southerly, and on the North side half a point northerly. Its velocity from 1 mile to 1½ and 2 miles per hour.

Between Granada and St. Vincent's, among the Granadines, the currents are devious; but the general inset appears to be W. by N.

Between St. Vincent's and St. Lucia the current, from the eastward, sets in more northerly; and within, on the West, it has been found setting to the N.W. Between these islands it seems to be as strong as in any other part of the range.

Between St. Lucia and Martinique it has been found nearly North. Very variable on the western side of the latter.

The current sets nearly in the same manner *between Martinique and Dominica. Northward of Guadaloupe* it sets W. ½ S.; and between *Montserrat and Antigua*, N.W.

At the distance of about 1°, *within the range of the Caribbee Islands*, and to the Virgin Islands, the current has been found setting, in general, to the W.N.W., from 1 to 1½ miles an hour.†

In the *Mona Passage*, between Porto Rico and Hayti, the current has been marked as frequently setting to the N.W., and we have instances of a set through to the S.W.; but Captain Monteath, in February, 1816, when proceeding southward toward Porto Rico, in from lat. 23½° to 22°, lon. 64° to 65°, found the current setting N.N.E. at the rate of 20 miles in the twenty-four hours: and he says, that off the N.W. point of Porto Rico it invariably set from the Caribbean Sea to the North and N.N.E. On the western side of the passage it set North, 2 miles an hour: but there have been instances of an inset from the N.W.

From Trinidad, westward, and off the North side of the Spanish Leeward Isles, the current has been found setting West and S.W. to the Gulf of Maracaybo; thence S.W. also to Cartagena: but it varies, as already described.

From Cartagena toward the *Channel of Yucatan* it has been found N.N.W., N.W., W.N.W., and N.W. by N., from 1 to nearly 2 miles, and then decreasing to 1¼ miles per hour. It has also been found setting to the eastward, as shown in the preceding pages.

The CURRENTS in the BAY of GUATEMALA, between Cape de la Vela and Cape Gracias a Dios, have been ably investigated by Captain William Sidney Smith, R.N., as shown in the *Colombian Navigator*, vol. iii. pages 245, 246.

BOTTLE EXPERIMENTS.—CARIBBEAN SEA TO YUCATAN.—A bottle from H.M.S. *Chanticleer*, in lat. 15° 29′, lon. 76° 3′, at noon on the 23rd of February, 1831 (the ship being to the southward of Jamaica), was picked up on the 20th of the next April upon the eastern coast of Yucatan, after having traversed over a distance of nearly 700 miles.

* Extracted from *Notes* by Captain G. Daniell, R.N., on a passage from Port Royal to Barbadoes and Anguilla, and thence to Maranham and Para.—*Nautical Magazine, Dec.* 1835.

† On the leeward side of the Virgin Isles devious currents are found, frequently to the south-eastward. The same have been observed on the western side of St. Christopher's, &c.; but see, hereafter, the Particular Directions for Navigating among the Windward Islands.

SERRANILLA TO YUCATAN.—A bottle from a boat belonging to H.M. surveying-ship *Thunder*, at anchor under Serranilla West Kay, 10th of March, 1834; picked up at Half-Moon Kay, in the Bay of Honduras, on the 23rd of the next month, April.

TOBAGO TO THE CAYMAN.—A bottle from the American brig *Emma*, on her way from Philadelphia to Berbice, 17th of June, 1838, in lat. 11° 4′, lon. 58° 50′; picked up on the 27th of the following August, upon the eastern shore of the Grand Cayman.

WINDWARD CHANNEL, between Jamaica and Hayti.—A bottle from H.M.S. *Thunder*, in lat. 18° 56′, lon. 74° 56′, 7th of April, 1839; current then setting S.W. by S. half a knot; picked up in the Grand Anse, near Jeremie (lon. 7° 1′), on the 24th of the same month.

HAYTI TO FLORIDA.—A bottle, some years ago, from the ship *Robert*, Captain Coulter, eastward of Alto Vela, on the South coast of Hayti; picked up about thirteen months afterward on the shore near St. Mary's in Florida.

At about 40 miles *northward of Cape Catoche* the current has been found N.W. by W.; changing thence to S.S.W. off the N.W. point of Yucatan, nearly at the same distance from the coast. Rate, something less than half a mile an hour. *Between this and Vera Cruz the current ceases.*

Three degrees to the N.N.E. of Vera Cruz the current has been found setting to the N.E. 1 mile an hour. Thence N.N.E. and N. by E., and again N.E., nearly to the parallel of 25½°, lon. 91½°. Here it changed more to the East, and became, in lat. 26°, E. by S., changing southward to the S.E. by S. in the direction of the River Mississippi, and lat. 25° 30′ N. Hence it sets, with some variations, toward the western end of Cuba.

On a passage between Vera Cruz and Havannah, 10th to 22nd *April*, 1828, Lieut. John Evans informs us that little or no current was perceptible.

On the 17th, at noon, in the Mexican Sea the vessel was in lat. 26° 52′, lon. 89° 17′. On this day *fucus natans*, or gulf-weed, was seen, in parallel lines, S.S.E. and N.N.W. It was in flower,* and completely covered with young barnacles. "From the lat. 25° to 28° in this sea we met with the fucus in parallel lines, S.S.E. and N.N.W.: it flowers like fern and other *cryptogamia*." In calms the fuci float near the surface, some of the leaves appearing above water; the patches seen in the Florida Stream, and the bunches examined, were old, brown, and covered with young barnacles.

The phosphorescent lights observed in the Mexican Sea shine with greater brilliancy (April) than I had noticed them elsewhere: some of these were very large, and flashed like the priming of a gun, sometimes at a long distance from the ship. I observed that the little shining spiracles were confined to the sides of the vessel and her wake, and that the waves, when they broke into foam, did not (as in other parts of the ocean) sparkle.

The colour of the water in the Sea of Mexico is of a dark indigo, darker or more intense than that of the ocean generally: the colour of the sea in the Florida Channel is a fine blue, not so dark as that of the Sea of Mexico, or of the ocean generally. Phosphorescent lights are equally abundant in the Florida Stream, some unusually large and brilliant; and some of the small lights appeared to spring out of the water, with a sweeping motion, which I had never before observed; the temperature of the water was 79°, that of the air, 76°.—J. E.

The current in the gulf, from Vera Cruz to the meridian of the Mississippi, is noticed above. We have shown that it commonly sets S.E. by S. in the direction of the River Mississippi, and lat. 25° 30′. The current hence sets variously to the south-eastward. Its extent and exact direction are unknown; but it is certain that, setting toward the N.W. of Cuba, and striking on the banks of Isabella and Colorados, a portion of it winds round Cape Antonio to the south-eastward, while the great body of it sets eastward, to the northward of Cuba, winding to the E.N.E., N.E., and North, through the Strait of Florida, and into the Atlantic Ocean, under the denomination of the FLORIDA or GULF STREAM, as shown on the chart.†

* This weed is described in the observations on the *Sargasso Sea* hereafter. It has already been noticed in page 208.

† At about 3½° North of Cape Antonio the current has, at times, been found setting to the S.W., winding toward the northern edge of the Yucatan Bank; but at a degree thence eastward setting nearly S.E. Off the West end of Cuba, at ½° N.W. from Cape St. Antonio, it

7. THE FLORIDA OR GULF STREAM.

This wonderful *Current* originates, as we have already shown, from the superior level of the waters of the Colombian and Mexican Seas; and, like an immense river, it wends its course eastward between Cuba and Florida; northward between Florida and the Bahamas, occupying nearly the whole breadth of the channel; and thence setting nearly parallel to the American coast, in a N.N.E., N.E., and easterly direction; until, gradually losing its impetus, it falls to the *southward* on the meridians to the West of the Azores or Western Islands, and is finally lost in the *Sargasso* or *Weedy Sea*.—(See page 208.) These are its general limits as to length, which may be estimated at more than 3,000 nautic miles from the Mexican Sea; but it is well known that, overflowing, its waters have at times extended eastward beyond the Azores, and even to the coast of Portugal and Bay of Biscay.

With regard to breadth, we shall, at present, observe only that its narrowest part is in the Strait of Florida, between the point named *Cape Florida* on the West and the *Great Bank of Bahama* on the East, a distance of 35 or 36 miles. The stream occupies nearly the whole breadth of this channel, and here sets with great velocity; off Cape Hatteras, about 700 miles more to the northward, its breadth is computed as generally about 75 miles; but it soon after expands to an indefinite extent, northward and eastward, as will be shown hereafter.

The latter part of the month of August and beginning of *September* is the period in which the Gulf Stream runs in its greatest strength and highest temperature. Its weakest and lowest is in February. Its greatest velocity is, at all times, in the narrows between the *Bemini Isles* and *Cape Florida*. Here in August it has been found to run more than 100 miles in the twenty-four hours; while, at a distance westward, it has not exceeded 70 miles, and northward, about 80. In October the stream is considerably weaker; and it fluctuates in all seasons according to circumstances. The border of the stream, near the Cuba shore, is generally weak; and here, at times, is even a *counter-current*, running westward, as before described. On the meridian of Matanzas the greatest velocity of the stream is on or near the parallel of 24°. The strength of its western and northern borders, in its entire and vast extent, is much greater than those on the East and South, which have invariably a tendency to spread over the ocean in whirls or eddies, and which are, therefore, comparatively weak.

The high temperature of the stream in the incipient portion of its course varies from 87 to 84 and 83 degrees; and this temperature decreases so slowly, that, by affecting the cold atmosphere of the N.E. region, it contributes to those storms which have been so frequent between the parallels of Newfoundland and the Bermudas.*

It has heretofore been said that the stream itself was moved by the wind; but from its vast depth and volume it is now held that this is impossible, and that the wind affects the *surface* only, although the borders or edges may be forced by it over the adjacent sea, or the edge of the sea over the stream; either cause producing the same appearances on the surface.

The current from the Mexican Sea, before entering the strait, runs at the rate of about 1½ miles in the hour. After entering, it increases to 2½, 3, and occasionally 3½ miles. On being compressed in the narrows, between Cape Florida and the Beminis, it has been found to run 5 miles at the *maximum*, in August, and seldom below 4 throughout the rest of the strait; and thence to lat. 31°, 3½ miles. This must be understood to mean the central and strongest part of the stream.†

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has been found setting S.W. by W. 1 mile an hour. But these cannot be considered as its *general directions*.

On the southern edge of the Tortugas soundings, June 23 and 24, 1820, lat. 24° 30′, lon. 83° 30′, Captain Monteath found the current setting E. by S. 20 miles in the twenty-four hours. Passing next day to lat. 24°, lon. 82° 20′, it was found to have set E. by N. 42 miles.

* For the use of those advancing westward, we have, in the first volume of the *Colombian Navigator* taken a view of the stream *inversely*, dividing it into four sections, beginning with the East, and including in each the temperatures, &c., as found in the different seasons. Other particulars will be found to accord with the present description.

† "The calculations of the velocity of the Gulf Stream are not to be depended on. I have

On the Cuba side, as above mentioned, the stream is weak, and it sets to the eastward.* On the opposite side, along the Florida Reefs and Kays, there is a re-flow or counter-current, setting to the S.W. and West. By the assistance of the latter many small vessels have navigated through the strait from the northward; but this navigation is too dangerous to be attempted by strangers. The tides set among these reefs, as shown in the preceding division of this work.

The winds are found to affect the position of the surface considerably. Between Cuba and Florida northerly winds press it southward toward the shore of the former; southerly winds have a contrary effect. When turned to the North, easterly winds press it to the Florida side, and westerly winds nearer to the Bahamas. Southerly winds cause it to spread, and so may those from the North.

In the Strait of Florida, within the Bahamas, when a northerly gale, increased to a storm, opposes the stream in its course, this adverse power causes it to fill all the channels and openings amongst the Martyr Isles and Reefs, and to overflow all the low coast.

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found it setting at the rate of 5 knots, and even upwards. This was on the 16th and 17th of August, 1817. On the 19th and 20th of February, 1819, it seemed to be almost imperceptible. In September, 1819, it set at much about the rate described in the charts."—*Andrew Livingston.*

One remarkable instance of its diverging from the usually supposed velocity is given in a kind communication of Captain Giles, of the bark *Charles*, who found it to run 5 and 5½ knots, in *January*, 1843. "The first day I began to make any material progress was with the Tortugas bearing about S.E.; the following day I had a current of 53 miles S.E. by S.; the next day, 60 miles S.S.E. ½ E. I was then in lat. 24° 10′, lon. 83° 0′ W. The weather would not permit our sighting the Tortugas, though we passed them very closely. The next day we made, by very good observations, 75 miles of due easterly current, which, with the ship's work, placed her in lat. 24° 12′ and lon. 81° 30′ W. The succeeding day, towards dark, the wind being strong from E.S.E., and considering myself in the vicinity of the indraught of the Great Inlet, I put the ship's head to the southward, under *close-reefed* topsails, and nothing more set, and reached her to till daylight, that being twelve hours good; towards noon it fell calm. I then found that we had been set nearly in the direction that the elbow of the land trends, *one hundred and ten miles*, we being at noon in lat. 25° 15′ N., lon. 79° 45′ W. The following day we had light, variable airs and calms, heavy rain, much thunder and lightning, and very thick weather (as it had been the day previously). We picked ourselves up at noon, lat. 27° 20′ N. and lon. 79° 30′ W., having had the current N. by E. *one hundred and twenty miles.* I intended to pass through the Providence N.W. channel, but the current swept us past the mouth of it in the light airs which we had on the last two days of our passage."

* What seems anomalous is, that the stream, along the North coast of Cuba, sets at times to the westward, probably all the way from the Bahama Old Channel. Of this we have several instances, from the communications of Captain Livingston and others; the most singular of these, however, is that of Captain Loudon, of the brig *Peru*, on returning, in the latter part of November, 1827, from New Orleans to Liverpool. Captain Loudon had made the *Iron Hills* in Cuba; shortly after noon he tacked ship to the northward and westward, about 8 or 9 miles off shore; next day he kept beating to windward, as near to the middle of the strait as he could judge, and without sighting the land on either side, the wind then blowing a fresh gale to the northward; and he continued beating in the same manner until about eight a.m. of the second day, when, by *reckoning*, he ought to have been near the Salt Kays; but obtaining a lunar observation, it showed, to his astonishment, his longitude to be to the westward of 83°. Supposing his observation to be erroneous, he took a second set of lunar distances, which gave a similar result. Still, however, doubtful, he stood on, and in a short time afterward gained soundings on the *Tortugas Bank!* The northerly gale had now abated, and he worked his vessel in, on soundings, to the northward of the Dry Tortugas. With a favouring wind he ran through the Tortugas Channel; but as light and baffling winds succeeded, he made for the stream as it became dusk, and with such wind got through the strait in the two following days, having, on his way, found the current very rapid along the Martyrs.

Captain Loudon justly remarked, that so extraordinary a circumstance, of which he is *positively certain*, ought to be generally known.

"Masters of vessels from Vera Cruz, &c., to Havanna, often lengthen their voyage by keeping away too much to the southward after rounding the Dry Tortugas, fearful of being carried away to the eastward of Havanna by the strength of the Florida Stream! Some have fetched in about the Port of Honda, the Cock's Comb, and one vessel even as low as Cape Antonio!"—*Lieut. John Evans.*

Shipping have even been carried over the low kays, and left dry on shore.* The water is supposed at times to have risen to the height of 30 feet; and to have been running against the fury of the winds at the rate of 7 miles an hour. During these times the Strait of Florida exhibits a scene terrific beyond description.

Besides the effect which different winds have upon the stream, it is subject to another power, that also directs it toward or from the coast; and that is, the moon, which, according to her position, has different effects upon it, not, however, in equal power with those of the wind; but the disposition of the stream is increased to its extreme, if the effect of both wind and the moon are combined; for, at this time, the ocean rising highest, this regulates the flood and ebb, and divides them in proportionate times; consequently it directs and increases them, with an easterly moon and wind to the West, and with a westerly moon and wind to the East; so that the West and East shores are at times deprived of, and at other times overflowed by, tides, occasioned by these vicissitudes.

The boisterous East, N.E., and North winds which affect the Gulf Stream, generally begin in September, and continue until March: when, if the moon happens just at the time to be on the full or change, they commonly end with a hurricane.

The stream from lat. 26° to 28° generally sets North, rather easterly. Between the parallels of 28° and 35° (or that of Cape Hatteras) it has a North, N.N.E., and N.E. direction. On the West it is bounded by the banks extending from the American shore, nearly parallel to which it runs, at varying rates, according to the season. The nearest edge of the stream, from the coasts of Georgia and Carolina, is about 40 miles; but it approaches nearer to that of Florida. The average breadth of the stream itself may be about 60 miles; less near Cape Canaveral, and more near Cape Hatteras. As it is supposed to fall down a steeply inclined plane at its exit from the strait, its velocity here is the greatest, and has at times been found at the rate of 5 miles an hour; but the average rate of the whole is about 3 miles.

"*In the month of July*, 1813, the fleet of merchant vessels from Jamaica, under convoy in the strait, from the 9th to the 14th, after passing the Double-headed Shot Kays, was becalmed, and the *current swept the whole through the strait by its strength alone.* By calculation it appeared to have run 60 miles in the twenty-four hours, or 2½ knots an hour. On the 15th the convoy was on the parallel of 27° North, with a fresh W.S.W. breeze: current, N.N.E. In the following year circumstances precisely similar occurred, in the same season; and the fleet was carried through the strait without a breath of wind."—*Colombian Navigator*, vol. i. p. 216.

The stream, instead of leaving the neighbourhood of the coast at Cape Hatteras, as formerly described, has been found to range up to the parallels of 38° and 39°, running at the rate of about 2½ knots: then George's and the Nantucket Banks appear to *front* it, and to throw it off to the E.N.E. and E. by N. northerly.

After passing Cape Hatteras, the western border of the stream ranges from N.N.E. to N.E., and thence bends eastward over the edge of George's Bank, &c., in or about the parallel of 40° N. Its *southern border*, in a N.E. and E.N.E. direction, crosses the parallel of 35° N. in about lon. 73° W., or 120 miles E. by S. from Cape Hatteras. Within this border the temperature, in the month of *September*, has been found as high as 83°; and even in *December*, as high as 74°. In the central parts of the stream, *westward of lon.* 70°, in the month of *October* the temperatures have been found to vary from 64° to 70°, while those of the air and ocean, without the stream, have been nearly equal.

Between the meridians of Cape Hatteras and 60° *W.*, near the northern edge, in 39½° N., temperatures of 62° have been found in *February* and *April;* but in the latter month, near the centre, or lat. 37° N., 66° have been found, and 70° at half a degree more to the South. In *May*, near the centre, 60° to 65° have been found. In *June* and *July*, 66° to 72°. In *August*, 77° to 80°, lat. 37° 20′, lon. 70°. In *September*, near the

* In the month of September, 1769, there happened an inundation, which covered the tops of the highest trees on the Cayo Larga, &c., and during which the *Ledbury* snow, John Lorain, master, was carried over the reef by the N.W. current of the stream, caused by a gale from the N.E. The vessel bilged in shallow water, but an anchor was thrown out, and the next day the vessel was found to have grounded on Elliot's Kay, with its anchor among the trees.—*De Brahm's Atlantic Pilot.*

northern edge, 71° to 74°; and near the southern border, 83°, as before mentioned. In October we find the temperatures reduced, 70° to 64°; but in the middle of the stream, even in November (lat. 38°), 71° have been found.

It has been before observed, but here it may be repeated, that the fluctuations or changes of the stream within itself are, however, so great that no precise temperature can be given for any particular time. If we take a section of the stream in a S.S.E. direction from New York Harbour, we may find, on soundings before entering the stream, in April, a temperature of 41° or 42°: on the parallel of 38° (100 miles farther out), 62°: thence again, only 54°, increasing southward to 70°, and again diminishing to 68° and 64°, where a *counter-current* of warm water from the stream has been found. The variations of temperature *within* the stream have given rise to the conjecture, that veins of colder water from the West mix occasionally with the main stream.* The *average* velocity in the strength of the stream exceeds 40 miles per day.

Lieut. J. C. Walsh, of the U.S.S. *Taney*, in 1849-50, made several interesting experiments on the temperature and extent of the Gulf Stream, the first in October, 1849. On the 31st of that month he first encountered the Gulf Stream, in lat. 37° 22′ N., lon. 71° 26′ W., the temperature of the water suddenly rising from 66° to 76° and 77°, the air being at 53° and 54°; by making a S.S.E. course good, they got out of it, judging from the water getting back to 70°, in lat. 36° 16′ N., lon. 70° 57′ W., the breadth being 71 miles; the velocity being about 3·6 knots per hour.

Re-crossing the stream, on his return, May 30th, 1850, he entered it in lat. 35° 30′ N., lon. 72° 35′ W.; the temperature at eight a.m. being 71·8°; at 50 fathoms, 71·8°; at 100 fathoms, 67°: the air, 70°. At noon, the surface was 78·5°; at 50 fathoms, 77·5°; at 100 fathoms, 72·5°: the air, 76°. Its velocity was 2·5 knots per hour, setting N. 77° S. He left it in lat. 36° 42′ N., lon. 72° 10′, bearing from the point of entrance N. 16° E. 78 miles, which, therefore, appears to be the breadth at this time. When on soundings next day, June 1st, in lat. 39° N., lon. 70° 30′ W., the water showed as low as 51° at the surface, and maintained an average temperature of 53° until he reached New York. This was a difference of 28° from the adjoining Gulf Stream. Shoals of porpoises and black fish were seen in the hot waters of the stream; but little gulf weed in it, but much at its outer edges.

On the Bank of Soundings, between the Gulf Stream and the coast, a breadth of about 40 miles, cold currents are commonly found, setting in a S. by W. direction; more particularly in the winter months, December and April, at the rate of about half a knot, or 12 miles in the day of twenty-four hours: these are mentioned hereafter.

Stream between the meridians of 70° *and* 65° W.—Between these meridians the *northern* edge of the stream appears as if limited by the edge of George's Bank, passing which it pursues a more northerly course, or nearly N.E. by E. to the meridian of 65°, which, in summer, it crosses above the latitude of 41°, but, in winter, considerably more to the southward.

The *southern edge* of the stream, in the same season, is found in about lat. 35°.

The greatest strength of the stream, in August and September, is in about lat. 37° 45′, where the temperatures have been found to vary from 79° to 82°. In September, near the northern edge, 68° to 72° have been found. In March, from 44° near the northern edge, to 73° in mid-stream. In June, from 65° on the northern edge, to 77° in the mid-stream. The velocities vary materially, even in the same month, but the average appears to exceed 30 miles per day.

Stream between the meridians of 65° *and* 60°.—This portion of the stream intervenes between the Bermudas and Nova Scotia, and it has consequently been more examined than the tracts to the eastward and westward. In summer its northern edge has been found in lon. 65°, on the parallel of 41° 20′; and in lon. 60°, as already noticed, in 42° 15′. Its southern border is indefinite, for we find warm water, in a *counter-current*, running W.S.W. in 35° 45′, with intermediate southerly offsets from the main stream.

The Temperatures.—In the spring of the year the temperatures of this region are

* These veins or tracts of colder water may arise from the current, which sets in a S.W. direction over the banks and along the coast: when this counter-current is of sufficient strength, it perhaps runs *beneath* the Gulf Stream, and, mixing with its warmer waters, causes this phenomenon.

occasionally disturbed by the presence of ices, which cool the water to a great extent around. Hence we find that, in March, the water has been cooled down to 44°, while in mid-stream, in lat. 38° 40′, it has been at 71°. In August and September, in the mid-stream, 80° and 81° have been found near the parallel of 38°, with a velocity of more than 2 miles per hour. In October and November, 76° to 78°. In December, 68° to 71°. In February, 59° to 64°. In May, without the northern border, in lat. 41° 10′, 44°; and within that border, in 40° 55′, 60°; in 40° 35′, 68° to 69½°. In July, 70° to 81°. The last temperature was found in lat. 39° 45′, lon. 62° 35′; but here, commonly, in the month of May, it does not exceed 69°. The general direction of the stream, between lon. 65° and lon. 60°, is E.N.E., and its daily velocity varies from 50 to 20 miles. It was within this limit, and near the parallel of 38°, that the ship *New York*, Captain Bennett, experienced the dreadful storm, in April, 1827, which is described in pages 129 to 132. Temperature of the air at the time, 48°; of the water, 74°!

The strongest part of the current prevails chiefly between lats. 37½° and 40°, lons. 63° and 65½°, and more particularly at about 38¾°, in lon. 64°. Between the southern side of the stream and the Bermudas the currents are variable, but set, as well as on the North side, mostly to the West.

An extended series of most interesting experiments on the physical constitution of the Gulf Stream—the first, it may be said, that will place its real character on a clear basis—has been carried on under the direction of the United States' Coast Survey, by Lieut. C. H. Davis, in 1845; Lieut. George M. Bache, in 1846; Lieut. S. P. Lee, in 1847; and Lieut. Richard Bache, in 1848. The mode of operation was to take a section of the stream usually at right angles to the general trend of the American coast, and, consequently, transverse to the line of the Gulf Stream. These sections commenced from Cape Cod, thence off New York, Cape Henlopen, Cape Henry, and last, Cape Hatteras.

In these experiments the temperature was gained from all depths, from the surface down to 600 fathoms. At great depths a peculiar thermometer was used, constructed for the purpose, whose principle of action depends on the differing expansion of two metals; it is a spiral coil, composed of two strips of silver and platinum soldered together, which act on an index, and which registers the extreme temperature ascertained, and was found to answer exceedingly well.

It would be impossible in this work to give, without diagrams, an exact insight into the nature of the results obtained by these experiments; the most remarkable of which, perhaps, is the boundary between the warm Gulf Stream flowing north-eastward, and the cold in-shore stream, which, as is elsewhere stated, is now considered to be a prolongation of the Arctic current. This separation assumes the character of a *perpendicular wall* of hot or cold water in juxta-position; and this very remarkable feature appears to be constant, and nearly maintaining one position with regard to the coast. This has been ascertained to exist to the utmost depths reached by the sounding apparatus, to the points where there seems to be a tendency to a common and low temperature of the deep water of the ocean.

The results of the operations of 1848 have rendered probable the curious fact, that the cold in-shore wall is cut off at Cape Hatteras, the hot water of the Gulf Stream extending quite into soundings. This remarkable circumstance, if confirmed, though it certainly appears evident from the experiments cited, will soon overturn the notion that this cold current continues its course as a submarine current across the course of the Gulf Stream.

There is some variation in the temperature of the Gulf Stream in different years, though a great uniformity is observed in this particular in taking an extended view of the current. In 1846, the highest temperature from the mean of 20 to 120 fathoms was about 130 nautic miles from Cape Henry; in 1847, about 135 miles; in 1848, about 125 miles; measured upon a line perpendicular to the stream, or about S.E. of the cape.

With respect to the temperature of the stream on its outer or S.E. side, there is the same uniformity of increase and decrease in varying depths as is observed in the stream itself; but the limits have not the same singular character that its inner face has, as before described. It here seems to be bounded, taking the temperature of 70° as the indication, at the distance of 180 miles S.S.E. of Cape Hatteras. It would also seem that the pressure of the colder stream had a tendency to press the warm water so closely, that near its line of separation it is frequently several degrees warmer than at some miles farther to the S.E.; the temperature again increasing as the distance S.E. is increased, until it attains the same *maximum*, and declines to the temperature of 70° at the distance above mentioned.

There is yet another feature to be noticed, as deduced from these experiments. It is, that there seems to be another branch of the Gulf Stream, or a separate warm current, parallel to it, but at 100 miles to the S.E. of it, and having a breadth of from 100 to 120 miles. This, though less distinctly marked, both as to temperature and definite extent, than the great stream itself, is still sufficiently obvious, by a careful examination of the details of these explorations.

These matters, though not of absolute practical importance to the sailor in directing him in his route, as his object will lead him to other pursuits than verifying such important and difficult experiments, are highly useful in explaining many of those apparent anomalies which at times perplex the mariner. It appears that the surface streams in many instances do not entirely coincide with the deeper seated currents, which, perhaps, may be the true system of circulation; but as it is only with the surface drift that a sailor is engaged, anything which can clear up difficulties in estimating their nature is highly serviceable. In a future work these great features of the Atlantic Ocean may, perhaps, be placed in a clearer light.

The following Remarks on the Stream were made by *Sir Philip Broke,* on the approach of winter, in October and November, 1811.

"During six weeks in October and November, 1811, three weeks within its influence, either crossing it between the parallels of 38° 30′ and 40° 30′, and lon. 60° to 63° by *observation*. Mostly continued blowing weather from N.W., S.W., or South. The current, irregular in velocity, but constantly to the E.S.E.: never less than 25 or 30 miles, and several times 50, in the twenty-four hours: always seen by *gulf-weed*.

"My chronometer was, at first, very correct, as we had opportunities of ascertaining by *lunar* observations: but I soon found, both from our own observations and the report of my brother officers, that the best chronometers became irregular in the *heavy, warm, damp air* over the stream; the thermometer standing at summer heat, and once at 80°, whilst it stood near the *freezing* point beyond its borders, as well to the South as the North.

"When the wind opposed the current, the sea was always heavy and broken, so as to occasion the ship to labour much under any trim of sail whatever."

These observations were confirmed in after cruises.

Sir Philip adds—"Those who have no reason for navigating in this stream, should always avoid it in the winter season; as the sea which then prevails is unusually heavy and irregular; the climate warm, squally, wet, and unsettled. During S.W. or West gales, the air is sultry hot, even in the winter; and in the lats. of 39° and 40°, when just beyond its influence, the weather is extremely cold."

"Between the lats. of 38° and 40°, lons. 56° and 64°, I have known cruisers thrown out of their reckoning 9 degrees of longitude in ten or eleven days by this current."—*Major Rennell's Investigation*, pp. 180, 181.

Remarks on the Stream, between the meridians of 61° and 66°, in the months of May and October, by Mr. *Edward Sabben,* master of H.M.S. *Niemen,* 1823.

"1st *May,* 1823; H.M.S. *Niemen,* Captain E. N. Sibly.—From two p.m. of April 30, being then in lat. 41° 40′, and lon. 63° 30′, to ten a.m. of May the 1st, when in lat. 40° 30′, and lon. 63° 10′, felt the influence of a current, which, by repeated observations, appeared to set S. 72° E., or nearly E.S.E. ½ E., $1\frac{3}{10}$ miles an hour. On the 3rd, at six p.m., in lat. 39° 10′, and lon. 65° 55′, the ship was in the middle of the Gulf Stream. At six p.m. on the next day, its southern edge was passed in lat. 38°, and lon. 64° 30′. The ship had now been set by the stream 1° 13′ due East, giving its velocity 2·3 miles per hour. The temperature of the water at two p.m. was 77°; at quarter-past three p.m., 76°; at ten minutes before six p.m., 72°; and at seven p.m., the same.

"Again, May 23rd, at ten p.m., lat., per account, 38°, and lon. 65°, entered the Gulf Stream, having previously found an *eddy setting westward,* and extending about 15 miles South of the stream. May 24, at half-past nine p.m., the ship was in lat. 40°, and lon. 61° 50′; and the current was then found to have set, during nine hours of the day, while accurate observations could be gotten, due East more than 3 miles per hour.

"Crossing the stream in October, 1822, during favourable weather, between 38° and 39½° N., and in lon. 63°, it was found setting S. 68° E. (nearly E.S.E.) 2·3 miles an hour, with an *eddy on its southern edge,* perhaps from 10 to 15 miles wide, running with about half that velocity."

With northerly winds, on the 11th of March, 1816, Captain Carlton, in the American ship *Grand Turk*, lat. 39° 8′, lon. 61° 36′, found the temperature of the air 44°, and of the water, 68°. On the next day, in 39° 36′, and 59° 3′, the air was 46°, the water, 66°, a difference of 20°.

On the 15th of March the ship had advanced to the S.S.W. of the Newfoundland Bank, in lat. 40° 42′, lon. 52° 47′, when it became remarkable that the temperature of the air was 64°, while that of the water had dropped to 59½°. On the next day, at half a degree from the southern edge of the bank, in 42° N. and 49° 51′ W., the air was 56°, the water only 43°. Here the temperature was evidently lowered by an admixture of the Arctic waters from the North or N.N.E.*

It has been stated generally by writers of ability, from the information of American coasters, that the northern edge of the stream extends to the latitude of 41° 20′ or 41° 30′, on the meridian of the Isle of Sable (60° W.); but this assertion has been controverted by others, who have averred that its northern edge never ascends beyond the parallel of 40°. The latter is exceedingly erroneous; for many instances prove the contrary. Colonel Williams, in his *Thermometrical Navigation* (Philadelphia, 1799), states that the whirlpools of the eddy on the northern edge of the stream have been seen in lat. 41° 57′, lon. 65° 1′. He also observed great quantities of weed, supposed to be on the northern edge of the stream, in lat. 41° 53′ lon. 15° 33′. It has subsequently been ascertained by Lieut. Charles Hare, R.N., that on the meridian of 57° W. in the summer season (the *rainy season* of the West Indies), the northern edge of the stream ranges up to 42¾° N.; and even in the winter months to above 42° N. This has been confirmed by many voyages to North America, assisted by chronometer, thermometer, &c., the last of which was made in the fall of the year 1839.

In the northern regions of the stream, when the cold upon land is in winter most intense, which is generally between December and March, heavy and continued gales very frequently prevail, which commonly proceed from between the North and West, across the course of the stream, from Cape Hatteras until past George's Bank, and bend its direction to the eastward; being aided at the same time by the discharge of the great bays and rivers, increased by the force of the wind blowing down them, and the constant supply of stream that passes along the coast of the Carolinas, the whole produces so strong a current to the eastward, as to render it impossible for a ship to approach the coast until a change of wind commences.

During the prevalence of a southerly or easterly wind, which is not so common here, it has been found that the current is forced close to, and in some parts upon, the edge of soundings; being thus bent in between the wind and the shoal grounds near the shore, the breadth is greatly diminished, and the velocity proportionably increased. This circumstance has been in particular observed from about the longitude of Block Island, along the edge of the Nantucket Bank, thence beyond George's Bank, and also along the coasts of Georgia and part of South Carolina. In the first instance, that the southerly winds forced the current to the edge of soundings, where it then ran from 1½ to 2 knots; and in the latter instance, that the easterly wind forced the current upon soundings. With West and N.W. winds, the stream would be removed some leagues farther off.

From what has been said, it is clear that the eddies about the edges of the stream must vary according to the circumstances above explained. Along these edges, but more particularly along the outer edge, there is generally a current in a different direction, which is accelerated by the wind in proportion to its strength, blowing contrary to the stream, and retarded, or perhaps altogether obstructed, by the wind blowing in the direction of the stream. In the latter case the limits of the stream will be extended.

Eastern Portion of the Stream, between the meridians of 60° and 30° W.—This portion of the stream is the most extensive, the most variable, and the most indefinable. On the meridian of 60°, we find its northern boundary in *summer* as high as lat. 42½°. It then advances to the southern side of the Newfoundland Bank, and is

* In the month of June and beginning of July, and sometimes later, the ices from the Arctic Seas are frequently coming down from the northward in dangerous masses. In the same season the fishing vessels are very numerous upon the bank, on and about the parallel of 45° N.; consequently vessels bound to the eastward from Nova Scotia, &c., will avoid both, and most safely cross the Grand Bank, at this time of the year, by keeping in, or not proceeding to the northward of, lat. 44°.—*Captain Hare.*

found even beyond this to pursue an E. by N. course, until it reaches 44½° North, on the meridian of 43° West, whence generally it inclines to the southward; and, finally losing its strength, it falls to the southward, westward of the Azores, between the meridians of 40° and 30° West. In the winter, the northern edge is from one-half to a whole degree lower in latitude than in summer, and does not, perhaps, exceed, on the meridian of 60°, 41½° North.

The southern border of this portion of the stream seems to have no definable limit; it having, as already noticed, an invariable tendency to incline southward, while the great volume to the northward sets to the East. The velocities in the latter vary from more than 50 to 20 miles per day in August, decreasing eastward; and as August, with the early part of September, is the season for its greatest strength, allowance for its diminution is to be made between this period and February, when the stream is weakest.

It is almost superfluous to state that the stream may generally be traced by its *heat* or *temperature*, and comparing this temperature with that of the ocean beyond its limits. In the northern parallels this is more remarkable than in the southern; for we find that near the parallel of 40°, between the meridians of 60° and 50°, a temperature of 79°, 78°, and 77°, is common in the month of September; and between the meridians of 50° and 40°, the temperatures of 70° to 74° are found. Near the same parallel (40°), in the month of March, we find between lons. 60° and 56° temperatures of only 65° to 60°; and between lons. 50 and 40, 59° downward, and varying materially according to the approach of ices and currents from the northward.

On the meridian of 60° the breadth of the stream, with its overflowing southerly waters, late in the summer, is about 350 miles. The *drift current* of the ocean, in more southerly parallels, and toward the Bermudas, runs counter to the Gulf Stream, and, though variable, more generally to the W.S.W. than to any other quarter. On the North of the stream there are various currents and ripplings, according to the winds.

The Gulf Stream is in *general* finally lost in the Sargasso or Weedy Sea, to the West and S.W. of the Azores, as we have shown in page 208, and which is more particularly described in Section III. hereafter. Southerly and S.W. winds, however, spread the surface water at times much farther to the E.N.E. and East, as shown by temperature; but its general limits are as described.

Remarks on the Stream, by Captain *W. J. Monteath.*—Between lat. 25° 40′ and 28° 20′, Captain Monteath found the current *in the strait* had set 80 miles in the twenty-four hours of June 27, 1820. On the southern border of the stream (northward of the parallel of Cape Hatteras), 6th July, 1820, lat. 35° 20′ to 36° 30′, lon. 72° 30′ to 71° 3′, Captain Monteath found the current setting N. 45° E. 75 miles in the twenty-four hours. Next day, July 7, to lat. 37° 40′, lon. 69°, he found it N. 53° E. 86 miles in twenty-four hours. On the following day, July 8, to lat. 38° 38′, lon. 67°, it ran N. 58° E. 30 miles. July 9, to lat. 39° 10′, lon. 66° 10′, westward only 10 miles. The observations were continued each day, by chronometer, which agreed within a few miles.

In the stream, on the 21st of March, 1824, lat. at noon, 29° 4′, lon. 79° 22′, *Captain Hamlin* found the stream had set North 83 miles: on the next day, lat. at noon, 31° 8′, lon. 79°, N.N.W. 63 miles.

Here we may remark, both from the observations of Captain John Wilson and Lieut. Hare, confirmed by the recent surveys of M. Lavaud, that the southern edge of the Grand Bank of Newfoundland does not extend, by more than a degree, so far to the southward as represented in former charts. In lat. 42° 50′, lon. 50° 20′, no bottom can be found with 150 fathoms of line; and it does not appear that any soundings can now be found to the southward of that parallel.

Remarks on the Stream, &c., by Captain *J. Steele Park.*—We have given on a preceding page (226) Captain Park's description of the north-westerly inset into the Mexican Sea, and his notice of the outset from the same. After rounding Cape Antonio, the land of Cuba was not seen. At this time (the latter days of May, 1824) the stream along the Florida side, and even in the strait, was by no means so strong as it is generally found. In the narrowest part, where, of course, we have a right to expect the greatest velocity, it was running at the rate of only 2½ miles in the hour. This was correctly ascertained by meridian altitudes of sun and moon, and an excellent chronometer.

"When we cleared the gulf," Captain Park adds, "I was anxious to keep in the influence of the stream, and pass near the tail of the Bank of Newfoundland, but it

came on to blow hard from the northward, in lat. 34° 35′, and lon. 72° 20′ (E. by S. from Cape Hatteras). This, of course, drove us away to the eastward, out of the favourite track, and we passed about 300 miles to the northward of the Bermudas. During this gale for several days a current was found to proceed from the eastward to the W.S.W.; but in lat. 38°, and lon. about 59°, the ship was in the Gulf Stream, setting finely to the N.E.

"On June 23rd, at noon, lat. 37° 51′, lon. 61° 54′; June 24th, lat. 39° 56′, lon. 57° 26′ (by altitudes and chronometer). Here the ship really made 4° 28′ of easting in the twenty-four hours' run, and the log gave only 3° 16′. In the same time much northing was made. The true difference of latitude was 125 minutes, but the log gave about 80 only. The vessel had been running all the time E. by N. by compass, and went through the water 173 miles. Allowing half a point of variation, gives the true course N.E. by E. ½ E. Subsequently, on making Scilly, there was not an error in the watch of a single mile.

"After the gale from the northward subsided, the winds became variable between N.W. and S.W. The ship passed near the South side of the Great Bank, and continued to carry a fine north-easterly current, at the rate of 30, 25, and 20 miles a day, until she reached lat. 43° 35′, and lon. 36° 50′, where it ceased."

Remarks by Captain Edward Sabine, made in H.M.S. Pheasant, 1822.

"There can be little hesitation in attributing the unusual extension of the stream in particular years to its greater initial velocity, occasioned by a more than ordinary difference in the levels of the Mexican Sea and of the Atlantic; it has been computed by Major Rennell, from the known velocity of the stream, at different points of its course, that, in the summer months, when its rapidity is greatest, the water requires about eleven weeks to run from the outlet of the Mexican Sea to the Azores, being about 3,000 geographic miles."

July and August are generally the months of the greatest initial velocity of the stream, and the period when the levels of the Caribbean and Mexican Seas are most deranged.

The initial velocity in November, 1822, was 70 miles in the twenty-four hours. The temperature 80·8° to 80·5°. After passing Cape Hatteras, 77 miles.

In the summer months the stream issues from the outlet with a velocity nearly one-third greater than at the period of the *Pheasant's* voyage; or the latter part of November, 1822.

On the 5th of December, 1822, the *Pheasant*, bound to New York, quitted the northern boundary of the stream in lat. 36½°, lon. 72¼°. In the stream, in lat. 36° 14′, lon. 72° 25′, the temperature of the surface water was 74°, and of the air, 65°. Between ten a.m. and noon the temperature had fallen from 74° to 62·4°, being a difference of 11·6°. The surface water on which the ship entered was in motion to the westward, at the average rate of 16 miles in the following twenty-four hours, and generally to the West and S.W. between the northern side of the stream and the banks on the coast of Maryland. This motion may be more properly characterized as a *drift* current, occasioned by the prevalence and strength of recent northerly gales, than as a *counter*-current. In approaching the bank (or soundings), the surface water at eight a.m. and at noon, on the 7th of December, was 59·5°; at three p.m. it had fallen to 54·2°; on which, upon sounding, bottom was found in 33 fathoms: on the following morning, in 30 fathoms, the surface was 53·5°, and at eight a.m. on the 19th, in 12 fathoms, but still with no land in sight (being 20 miles off the coast), 49·5°. In the afternoon of the same day, when about 2 miles distant from Sandy Hook (New York Harbour), the water had finally lowered to 45°. Thus, in a space of the ocean scarcely exceeding 200 miles in direct distance, the heat of the surface progressively diminished from 74° to 45°.

BOTTLE EXPERIMENTS, ETC.

The Stream.—A bottle from H.M.S. *Breton*, Hon. Captain Gordon, 2nd February, 1830, in the Mexican Sea, lat. 27° 50′, lon. 84° 49′, the Tortugas bearing nearly S.S.E. 215 miles; found 2nd of June, 1830, in lat. 25° 52′, lon. 80° 9′, on the south-eastern coast of Florida, near White Inlet, where there is now a settlement.

A bottle from the *Lark*, steamer, lat. 24° 29′, lon. 83° 10′, on the 12th of July, 1838; found on the beach of Looe Kay, Florida Reef, in lat. 24° 31′, lon. 81° 31′, May 20, 1839.

BETWEEN the STREAM and BAY OF FUNDY.—To the northward of the Gulf Stream a bottle was cast from the *Romney*, a troop-ship, Charles Brown, commander, on the 13th of May, 1833, in lat. 42° 10′, lon. 66° 25′. Wind, S.W. Temperature of the air, 50°; of the water, 38°. Picked up, 13th of June, 1833, in St. Mary's Bay, at the West end of Nova Scotia, 6½ miles below the chapel, and about 10 miles N.E. from Cape St. Mary, and not, as formerly stated, in St. Mary's Bay, Newfoundland.

GULF STREAM to the AZORES.—A bottle from H.M.S. *Newcastle*, 20th of June, 1819, in lat. 39° 12′, lon. 63° 52′; found on the beach of St. George, one of the Azores, 20th May, 1820, in about 38° 40′ N., and 28° W.

GULF STREAM to IRELAND.—Another bottle from the *Newcastle*, 20th June, 1819, in lat. 38° 52′, lon. 64°; found on shore on the Rosses, on the N.W. coast of Ireland, near the Isle of Arran, 2nd June, 1820, and to which it must have been conveyed by the great easterly and northerly currents, after leaving the Gulf Stream.

A bottle from the *Dove*, Captain Kehoe (no date), lat. 16° N., lon. 78° W. Found on the Ballyteigue coast, Wexford, about 16 miles from the Hook Lighthouse, in August, 1837. (*Conjectured to have been impelled to the West end of Cuba, and thence through the Florida Stream, &c.*)

GULF STREAM to ST. GEORGE'S CHANNEL.—A bottle from the packet ship *South America*, March, 1833, cast into the Gulf Stream off Cape Cod, in lat. 40° 30′, and lon. 68°. Found, in the year 1834, at Southport, on the coast of Lancashire.

A bottle from the ship *John Esdaile*, H. King, commander, thrown into the sea 28th July, 1821, in lat. 36° 55′, lon. 71° 50′, was picked up on the sand near the mouth of the Ribble, Lancashire, 5th December, 1822. It was, therefore, after leaving the stream, set to the north-eastward.

LONGITUDE 44° to the ENGLISH CHANNEL, &c.—A bottle from the steam-ship *British Queen*, Captain J. Hamilton, 10th of August, 1838, ten days from New York, in lat. 43° 53′, lon. 44° 33′; picked up at Nieuport, near Ostend, October 15th, 1838.

INDICATIONS OF THE GULF STREAM.

The indications of the stream are the *appearance* and the *temperature of the water*. 1. The stream, in its lower latitudes and usual course, in fair water, where it flows uninterrupted, may be known by its smooth and clear blue surface; for, without the line formed by a ripple on its edge, the water in some places appears like boiling water of a blue colour; and, in other places, it foams like the waters of a cataract, even in dead calms, and in places which are fathomless.

On the outer edge of the stream, especially in fair weather, there are great ripplings, which are very perceptible. The appearance of the sea-weed, by day, is an indication of this edge of the stream; this weed being, *commonly*, on the edge without the stream, in greater quantity and larger clusters than within it.

It has been said that the water within the stream does not sparkle in the night. We are assured by Captain Livingston that, though this is a common, it is a misconceived, idea. "I have frequently seen it sparkle much; even last night it sparkled considerably, when we were in about 25° N., and 80° or 79° 40′ W.; and off Cape Roman, Cape Fear, Cape Hatteras, and the entrance of the Delaware, I have seen the water sparkle pretty much, though I think not equal to what it does in many other parts of the ocean."—*In the Stream*, 10th September, 1818. *A. L.*

The error, as to its not sparkling, has been shown also by Commissioner Ellicott, whose remarks are given hereafter.

The second and best indication of the stream is *the temperature of its water*, which is considerably warmer than the water on either side of it. By an ingenious work, entitled "THERMOMETRICAL NAVIGATION," written by Colonel Jonathan Williams, and published at Philadelphia, 1799, we are informed that *Commodore Truxton*, of the American Marine, had often ascertained the velocity of the Gulf Stream, to the northward of Cape Hatteras, and found it to be seldom less than 1 knot, and never more than 2 knots, an hour. The temperature of the air and water without the stream was generally about

the same; that is, the difference seldom exceeded 2° or 3°; the air being sometimes the warmest; at other times the water.*

This gentleman has observed, "In the stream the water is much warmer than the air; indeed, I have known it 10° warmer; but as soon as you get within the stream (that is, between it and the coast), the water becomes colder than the air; and the more as you get on soundings, and approach the shore.† If mariners, who have not the opportunity of determining their longitude by celestial observations, will only *carry with them a good thermometer*, and try the temperature of the water, and compare it with that of the air every two hours, they may always know when they come into, or go out of, the Gulf Stream. Indeed, I have always made a practice, when at sea, of comparing the temperature of the air and water daily, and often very frequently, during the day, throughout my voyage: whereby I immediately discovered anything of a current that way going, and afterward found its strength and directions by observations for the latitude and longitude. It is of the utmost consequence, in making a passage to and from Europe, to be acquainted with this Gulf Stream; as, by keeping in it, when bound eastward, you shorten your voyage; and by avoiding it, when returning to the westward, you facilitate it inconceivably: so much so, that I have frequently, when bound from Europe to America, spoke European ships, unacquainted with the strength and extent of it, off the Banks of Newfoundland, and been in port a very considerable time before them, by keeping out of the stream; whereas they lengthened their passage by keeping in it. The general course of the Gulf Stream being marked on the chart, I would advise those who make the northern passage from Europe never to come nearer the inner line of it, by choice, than 10 or 15 leagues; and then the probability will be that their passage will be assisted by the help of a counter-current, which often runs within it. In coming off a voyage from the southward, be sure to steer N.W. when approaching the stream, if the wind will permit you; and continue that course until you are within it, which may be easily known by the temperature of the water, as before mentioned. I have always considered it of the utmost consequence, when bound in, to cross the stream as speedily as possible, lest I should be visited by calms or adverse winds, and by those means driven far out of my way, which would prolong the voyage considerably, especially in the winter season."

By the advantage of knowing how near to the coast a ship may venture, and how to distinguish the Gulf Stream from the water between it and the coast, we can be sure of

* "Notwithstanding what Commodore Truxton says of its velocity off Cape Hatteras, in August, 1817, it set me, in the *Young Dasher*, 1° 8′, by stellar and solar observation, to the northward of dead-reckoning, in sixteen hours; and Captain Israel Coltart, of Philadelphia, informed me that it set occasionally with even greater rapidity."—*A. Livingston.*

† By the journals of Captain W. Billings, of Philadelphia, it appears that, in June, 1791, the water on the *coast* of America was at the temperature of 61°, and in the Gulf Stream at 77°. By those of Mr. Williams, it appears that, in November, 1789, the water on the coast was 47°, and in the Gulf Stream at 70°, viz.:—

1791, June, Coast	61°	1789, Nov. Coast	47°	Difference between June and Nov.	Coast	14°
Stream	77	Stream	70		Stream	7
Stream warmer	16		23			

The difference of heat is, therefore, greater in winter than in summer. See the concluding observations hereafter.

In the *America*, of 500 tons, Captain Heth, for Richmond, Virginia, 2nd May, 1817. "After a series of baffling winds and boisterous weather, we find ourselves on the western, or in, side of the Gulf Stream, and, of course, not far from our destination. Yesterday the temperature of the air was 65°, and of the water, 71°. To-day, the air remains at 65°, but the water has fallen to 50°. We have, therefore, crossed this warm ocean river, which flows from the Gulf of Mexico."—"NOTES" *of Maurice Birkbeck.*

"On my voyage from Philadelphia to Kingston, Jamaica, on board of the schooner *Young Dasher*, October, 1817, I particularly attended to the thermometer. Close off the mouth of the Delaware, in about 16 fathoms, it stood at 60°; on the inner edge of the Gulf Stream, it rose pretty rapidly to 66°, and, in the course of an hour, to 76°; next morning, 78°, which heat continued till we were to the southward of Bermuda; whence it gradually increased, until between Cuba, Hayti, and Jamaica, it was 82°, which appears to me to be the mean temperature of the sea water about Jamaica."—*From memory*, 26th August, 1818. *Andrew Livingston.*

a favourable current either way, and a small vessel might make a short voyage from Halifax to Georgia, which is thought by some a longer one than to Europe.—Suppose you had the wind ahead all the way; take your departure and stand for the stream; so soon as you find the water increase in heat, about half as much as you know it would when in the stream, heave about, and stand for the coast; you will infallibly discover the edge of soundings by the cooling of the water; then stand off again, and so on to the end of the voyage; when it is almost certain that the distance would be run in a shorter time than if there were no stream; for you would have a favourable inside current. On the return passage, take your departure, and run off till you get into the warmest water, which will be the middle of the stream, and take the advantage of its current.

The following fact may serve to illustrate the propriety of these directions. In June, 1798, the mail packet for Charlestown had twenty-five days' passage in going, but returned in seven. The captain accounted for this by having calms, or very light airs, and a northerly current. This was the true cause. He was in the middle of the stream, where there generally are calms or light winds; the edges, only, which come in contact with colder regions, being tempestuous. After being in the latitude of Cape Hatteras, he found himself in that of Cape Henry (37 leagues to the northward). The vessel, however, arrived at last; and on the return voyage the captain steered the same course back again, and with the same light airs he performed the voyage in seven days. Had the captain known the use of the thermometer, need he to have been much longer in going than in coming?

It appears also by the work above quoted, that the thermometer is not only useful for ascertaining the current of the Gulf Stream, but that it is likewise advantageous in discovering the approach to soundings from deep water.

In June, 1791, Captain W. Billings, of Philadelphia, in lat. 39°, lon. 56°, abreast of the Banks of Newfoundland, found that the mercury in the thermometer fell 10°. It was near the same place that a similar observation was made by Dr. Franklin, in November, 1776; and another by Mr. Williams, in November, 1789, who has observed that, "By the coincidence of these three journals, at so great a distance of time, and without any connexion with each other, this important fact seems to be established:—A NAVIGATOR MAY DISCOVER HIS APPROACH TOWARD OBJECTS OF DANGER, WHEN HE IS AT SUCH A DISTANCE AS TO BE ABLE EASILY TO AVOID THEM, BY ATTENTIVELY EXAMINING THE TEMPERATURE OF THE SEA; the water over banks and shoals, in these regions, being colder, in general, than that of the deep ocean."

Now although this remark, that low temperature indicates shoal water, holds good in most respects in this part of the ocean, or between the American coast and the Banks of Newfoundland, it must not be supposed that it is applicable to all cases, as the assertion seems to be proved now to be founded on a fallacy, and was only promulgated from the curious feature, then unsuspected, of a cold arctic current flowing over the Newfoundland Banks, and down, southward, along the American coast, *inside* the warm Gulf Stream, whose inner edge is almost *coincident throughout with the edge of the bank of soundings;* and hence it has been assumed that it was the less depth of the ocean caused the phenomenon, but this will be explained in a subsequent page (see Section VII. of the Appendix hereafter), as due to this cause almost exclusively.

Still the thermometer as an aid to navigation, especially in the vicinity of such remarkable currents as these, cannot be too highly spoken of; therefore the ensuing remarks will carry all the weight that can be attributed to them, apart from the principle upon which they were at first based.

At the edge of the Grand Bank of Newfoundland the water has been found 5° colder than the deep ocean to the eastward. The highest part of the bank is 10° colder still, or 15° colder than the ocean eastward.

On the coast of New England, near Cape Cod,* the water out of the soundings is 8° or 10° warmer than in soundings; and in the stream it is about 8° warmer still: so that,

* The bank from Cape Cod extends almost as far as Cape Sable, where it joins the Banks of Nova Scotia, deepening gradually from 20 to 50 or 55 fathoms, which depth there is in lat 43°. In crossing the bank between lat. 41° 41′ and lat. 43°, the bottom is very remarkable: on the outside it is fine sand, shoaling gradually for several leagues; on the middle of the bank it is coarse sand or shingle, with pebble stones; on the inside it is muddy, with pieces of shells, and deepens suddenly from 45 or 48 to 150 or 160 fathoms.

in coming from the eastward, a fall of 8° will indicate your leaving the stream, and a farther fall of 8° will indicate your being on soundings.

On the coast, from Cape Henlopen to Cape Henry, the water out of soundings is 5° warmer than in soundings; and in the stream, about 5° warmer still; so that, in coming from the eastward, a fall of 5° will indicate your leaving the stream, and a farther fall of 5° will give notice of soundings.

Colonel Williams recommends to seamen to take three thermometers. "Let them," he says, "be kept in one place some days previous to your sailing, in order to try their uniformity. The plate should be of ivory or metal, for wood will swell at sea, and, as the glass tube will not yield, it is for this reason very liable to break; bell metal is the best. Let the instrument be fixed in a square metal box, the bottom of which, as high as the mark 30°, should be water tight, so that, in examining the degree of heat, the ball may be kept in the water; the remainder of the length should be open in front, with only two or three cross bars to ward off any accidental blow, like the thermometer used by brewers. Fix one instrument in some part of the ship, in the shade; on part of one of the after stantions, under the quarter-rail, may answer, if no better place can be found.

"Let the second instrument be neatly slung, with a sufficiency of line to allow it to tow in the dead water of the wake. Put the other away safely, to be ready to supply the place of either of the others, in case of accident."*

To the foregoing observations the editor has the satisfaction of adding, from the information of Mr. Rowland Bourke, commander of the ship *Archibald*, from the Havanna to London, 1816, that he made experiments on the temperature of the water, which verified the principle developed by Colonel Williams. These experiments were made on leaving the Gulf Stream, and on approaching soundings upon the edge of the Newfoundland Bank. Captain Bourke had been perusing a former edition of the present work; and, having accidentally a thermometer on board, "he thought," to use his own words, "that he might as well try, by the temperature of a few buckets of water, whether it answered or not." The particular results were not committed to paper; but, in one instance, the captain recollects a difference of 7° in the temperature of the water, within the space of a short time, when leaving the stream: subsequently a fall of several degrees announced the ship's approach to the Bank. In brief, the whole accorded with the preceding explanation, and proved the great utility of an instrument, with which, in these respects, many seamen are yet unacquainted.

COUNTER CURRENTS, &c.—On each side of the Gulf Stream, as before noticed, there is commonly a drift or counter current setting in a different or contrary direction. Thus, in the Strait of Florida, between the stream and the coast, a smooth eddy takes its current, south-westerly, in an opposite direction to that of the main stream; and there is, even in its higher latitudes, a re-flow on either side.

Again, to the northward of Cape Canaveral, along the southern coast of the United States, you will find no tide farther out from the shore than in 10 or 12 fathoms of water; from that depth to the edge of soundings you will have a current setting to the southward, at the rate of one mile per hour; when out of soundings, you will have the Gulf Stream setting to the northward.

It has been found that when Cape Henry (the South point of the Chesapeake) bore N.W. 160 leagues distant, a current was setting to the southward at the rate of 10 or 12 miles per day, which so continued until Cape Henry bore W.N.W. 89 or 90 leagues; the current was then found setting to the N.E. at the rate of 33 or 34 miles per day, which continued until within 32 or 30 leagues of the land; then a current set to the southward and westward, at the rate of 10 or 15 miles per day, to within 12 or 15 miles of the land.

Upon soundings, along the coast of Georgia, Carolina, Virginia, New Jersey, and New York, the current runs in general parallel to the shore; and is commonly influenced by the wind, which mostly prevails from between the South and West, producing a slow current of about one mile or half a mile an hour to the N.E.; but, when the North and East winds prevail, the current along shore to the S.W. will frequently run 2 miles; on which the pilots of this coast remark, that the South and S.W. currents are always stronger than those to the northward. It is probable the tides may have some in-

* A description of a case for the thermometer, intended to ascertain the temperature of the sea, is given in the Appendix, hereafter.

fluence on these currents, particularly near the entry of the great bays and inlets. The flood on this coast comes from the N.E. In the months of April and May I have observed, on crossing the Gulf Stream, in the latitude of Cape Henry, that when near the inside of the stream, the water begins to colour of a deeper green: and thence to the edge of the soundings there is a strong current to the eastward. The colour of the water, from green, turns to muddy, when on soundings, the current still continuing until within the influence of the tide: this eastern current is, no doubt, occasioned by the discharge of water out of the Chesapeake by the floods, from the snow melting in the country; and it prevails, in some degree, throughout the year, but its effect is greatest at this time. It is probable that a similar current prevails off the mouth of the Delaware.

Round the East end of Long Island, and thence to the eastward, round Nantucket Shoals, across George's Bank to Cape Sable, a strong tide runs; the flood setting to the North and West, in order to fill up the bays, rivers, and inlets, and the ebb the contrary. The tides that set across George's Bank into the Bay of Fundy are very much influenced by the winds, particularly if, after a strong South or S.E. wind, it should suddenly change to West or N.W. (circumstances that often happen); ships will then find themselves drifted by the outset 50 or 60 miles in the twenty-four hours, or more, to the S.E. The indraught is also great with South or S.E. winds, which ought to be paid particular attention to.

Upon the Nova Scotia coasts the currents run parallel to the shore, but are more frequent from the eastward than from the westward, particularly in the spring; the southerly winds force them upon shore by the water running in to fill up the bays and inlets; and the North and N.W. winds have the same effect in forcing them off the shore. A regular tide here runs along shore; the flood from E.N.E.

This *reflowing current* has usually been considered as an eddy caused by the Gulf Stream; but as several circumstances are incompatible with that supposition, it has attracted some inquiry as to its source; and although we are not aware of any actual experiments that have been made, which would set the question at rest, yet the concurrence of many phenomena will point tolerably clearly to the direction we are to look for its origin. It was considered by *Captain Ponton* that this current was a prolongation of the Newfoundland Current; and in the section on that current, hereafter given, there will be found other particulars relating to this supposition. Mr. W. C. Redfield drew up a summary of remarks and suggestions for the observers of the United States' Exploring Expedition in 1838, and which paper was read before the American Philosophical Society, in May, 1843. From that paper we will make a few extracts.

"...... From what source is that south-westerly current derived, which commonly prevails along the coast of the United States, in the direction which is opposite to the Gulf Stream?

"I am aware that it is usually considered by seamen as an eddy current derived from the Gulf Stream; but from this view I am compelled to dissent. For, in the first place, this current never assumes the gyrating form of an eddy; but continues its course, when unobstructed by gales, in a direction which is generally parallel to the coast. But, secondly, in case this current be derived from the Gulf Stream, it must necessarily partake of the same elevated temperature; whereas the reduction of temperature which occurs on crossing the north-western limit of the Gulf Stream is most remarkable, and is almost without a parallel in the Atlantic, except in the immediate vicinity of ice.

"It appears vain to allege the proximity of soundings or shallows as explaining this extraordinary change of temperature, for this cannot avail if the waters of the countercurrent be derived from the Gulf Stream, to say nothing of the erroneous character of the position here noticed.

"From the evidence which is afforded by numerous facts and observations, it appears that the current in question is neither more nor less than a mere sluggish prolongation of *the Polar* or *Labrador Current*, which sweeps along the north-eastern shores of this continent and the Island of Newfoundland; and this current, if I mistake not, may be traced in its gradations of temperature, by the thermometer, from off the southern coasts of Newfoundland and Nova Scotia, through the entire distance, to Cape Hatteras, if not to Florida.*

* These views are also entertained by Captain White, but he refers them to *tidal* operations, although it certainly would seem that the great current from the Arctic Seas can scarcely be

"An eddy current, off-setting to the Gulf Stream, would nowhere be so likely to be met with as at the point of intersection of this stream with the extremity of the Grand Bank of Newfoundland, and sweeping from thence upon the southern shores of the island of that name; and yet the Harbour of St. John's, in the southern part of Newfoundland, is known to have continued ice-bound, in 1831, so late as the month of June, although in the latitude of Paris. This fact is a convincing proof of the unimpeded continuation of the Polar Current to the southward, in this region, notwithstanding the near proximity of the Gulf Stream."

OFF-SET OR EASTERLY DRIFT FROM THE GULF STREAM, ON THE NORTH AND N.E. OF THE BAHAMAS, ETC.

From the superior elevation of the Gulf Stream, its water about the Bahamas appears to have a drift or tendency to the eastward: and there is reason to believe that an off-set of the stream, from without the Maternillo Bank, sets, if not generally, very frequently, to the eastward and S.E. With the usual set of the currents along the eastern range of the Bahama Islands, we are not accurately acquainted; but with a N.W. wind we have no doubt that it is in a S.E. direction. The *Europa*, a ship of war, returning to Jamaica by this passage from a cruise off Havanna, in 1787, steered East on the parallel of 30° N. with a westerly wind, until the run was supposed to have brought her on the meridian of Turks' Islands, by which it was intended to pass southward; but an *easterly* current had swept her along as high as that of the Mona Passage. Captain Manderson, of the Royal Navy, who first noticed this event, observes, "If it were once ascertained that a current was common in that part of the ocean, might it not be favourable for vessels bound from Jamaica to the Caribbee Islands, especially in the summer months, during the prevalence of the sea breezes?"

Our respected friend, Captain Livingston, says:—"I have no doubt that there is a current, or rather off-set, from the Gulf Stream to windward, between Bermuda and the Bahamas. In the *Brilliant* we found ourselves retarded very much in making westing when running for the Hole in the Wall, one day, about 30 miles of longitude, by excellent observations, the truth of which was confirmed by our land-fall. In the *Dispatch*, we got out of the gulf on the 13th of March, 1819, when we were at noon, by observation, in lat. 28° 0′, lon., by account, 79° 12′: on the 20th of March, at noon, we were, by meridian altitude, in lat. 29° 48′, and lon., by account, 72° 32′. Observations by sun and moon, a good lunar of three sights, altitudes and distances, and worked three times, gave 71° 18′ 30″.

"In the schooner *Young Dasher*, January, 1818, I spoke an American vessel, out five days from the Chesapeake, in lat. 24° 40′, or thereabout; my longitude by lunars was then about 69° 50′; his, by dead-reckoning, was 72° 20′. On the 11th of February, 1819, in lat. about 25° 10′ N., we spoke the schooner *Hester*, Captain Lawrence, out five days from Bermuda, bound to Jamaica: his lon. was 69° 15′; ours, by observation, 68° 39′.

"In the ship *Fame*, Captain J. W. Monteath, a good lunarian, assured me that he had been carried 3° and upwards to the eastward, between the time of his departure from the American coast and making the Windward Passages: but this may have been partly occasioned by the Gulf Stream, which he may have crossed too obliquely in proceeding from Norfolk." The *Fame*, above mentioned, was bound from Norfolk, in Virginia, to

called a tidal stream. "This natural propensity of the tide from the Greenland Sea may be actually traced, and almost continuously too, to the vicinity of St. Augustine, in Florida, and even to the cape of that name; and though it becomes temporarily merged in the Gulf Stream, during its farther progress again appears running to the south-westward, between the Isaacs and the Berry Islands to the eastward; and south-eastward at the Lobos and Guincho Kays, and at Porto Rico," &c., &c.—*Remarks on the Winds, Tides, Currents, &c.*, p. 54. Concerning the latter theory, it may reasonably be doubted whether the south-westerly current, if it should have its origin in the Greenland Currents, should in its weakened velocity and lesser volume be able to penetrate, and actually to cross, the mighty Florida Stream, in that portion of its course where it has the greatest velocity and most concentrated force, and to form an independent stream, after making such a transit. The ideas previously promulgated by Mr. Redfield, as detailed, are much more feasible, and this question is still open for practical illustration and research.

Kingston, Jamaica, in May, 1816; and in a run of thirteen days, until in the lat. of 29°, and lon. 61°, it was found that the current had set the vessel 3° 10′ East.

Captain Livingston adds, that "Captain Hall, in the brig *Lowland Lass*, passed to windward of Porto Rico, when he thought that he had run through the Mona Passage. Captain Patterson, of the brig *Clyde*, as I am informed, passed down the Anegada Passage, when he intended to have made the Mona. I have heard of two vessels falling to *leeward*, but both were commanded by men whose names, as *seamen*, are not entitled to notice.

"In addition to the above notices, I have been assured, by an intelligent Spanish navigator, that about thirty years since, vessels bound from Havanna to Europe used generally to cut off 3° of longitude from their reckoning, on account of this set, which he said was considered then as certainly existing. At that time the charts were about a degree wrong, which would reduce the Spaniard's allowance to 2 degrees, or thereby.

"These notices tend to prove that an easterly off-set from the Gulf Stream sets to the northward of the Bahamas: of this I am so firmly convinced, that if in charge of a ship from the Havanna, or even New Orleans, bound to Jamaica, I should, if allowed to follow my own plan, run out the Strait of Florida, and attempt making my passage with the aid of this off-set. This is to be understood, in case I should not have westerly winds in the southern parallels; for such winds are, I am told, more frequent than formerly; and I know that they are by no means of rare occurrence on the S.W. of Cuba."*

Observations on the Gulf Stream, etc., by Sir Charles Blagden, M.D. and F.R.S.

Extracted from the "Philosophical Transactions."

"During a voyage to America, in the spring of the year 1776, I used frequently to examine the heat of sea water, newly drawn, in order to compare it with that of the air. We made our passage far to the southward. In this situation the greatest heat of the water which I observed, was such as raised the quicksilver, in Fahrenheit's thermometer, to 77½°. This happened twice; the first time, on the 10th of April, in lat. 21° 10′ N., and lon., by our reckoning, 52° W.; and the second time, three days afterwards, in lat. 22° 7′, and lon. 55°; but, in general, the heat of the sea, near the Tropic of Cancer, about the middle of April, was from 76° to 77°.

"The rendezvous appointed for the fleet being off Cape Fear, our course on approaching the American coast became north-westward. On the 23rd† of April, the heat of the sun was 74°; our latitude, at noon, 28° 7′ N. Next day the heat was only 71°; we were then in lat. 29° 12′; the heat of the water, therefore, was now lessening very fast, in proportion to the change of latitude. The 25th, our latitude was 31° 3′; but though we had thus gone almost 2° farther to the northward, the heat of the sea was this day increased, it being 72° in the morning, and 72½° in the evening. Next day, the 26th of April, at half-past eight in the morning, I again plunged the thermometer into sea-water, and was greatly surprised to see the quicksilver rise to 78°, and higher than I had ever observed it, even within the Tropic. As the difference was too great to be imputed to any accidental variation, I immediately conceived that we must have come into the Gulf Stream, the water of which still retained great part of the heat that it had acquired in the

* Captain Thomas Hamlin, in the brig *Recovery*, then in the Gulf Stream, was set to the northward 104 miles, in the twenty-four hours of the 20th March, 1820. The ship's place at noon, 28° 4′ N., 79° 50′ W. To the north-eastward, on the next day, without the stream, in lat. 29° 35′, lon. 77° 25′, the current was found to have set only 11 miles North, but considerably more to the eastward.

On the 16th February, 1811, the ship *Mars*, under the same commander, was at the back of the Maternillo Bank, and no northerly current was found; and nearly 2° farther eastward, in 28° 7′ N., and 76° 58′ W., the current in twenty-four hours had set 3° S. and 14° E. The ship was, therefore, evidently in the off-set from the Gulf Stream.

† From the difference between civil and astronomical time, it becomes necessary to observe that the former is always meant in this paper.

torrid zone. This idea was confirmed by the subsequent regular and quick diminution of the heat: the ship's run for a quarter of an hour had lessened it 2°: the thermometer, at three-quarters after eight, being raised, by sea-water fresh drawn, only to 76°; by nine the head was reduced to 73°; and, in a quarter of an hour more, to 71° nearly: all this time the wind blew fresh, and we were going 7 knots an hour on a north-western course. The water now began to lose the fine transparent blue colour of the ocean, and to assume something of a greenish olive tinge, a well-known indication of soundings. Accordingly, between four and five in the afternoon, ground was struck with the lead, at the depth of 80 fathoms, the heat of the sea being then reduced to 69°. In the course of the following night and next day, as we came into shallower water, and nearer the land, the temperature of the sea gradually sunk to 65°, which was nearly that of the air at the time.

"Unfortunately, bad weather on the 26th prevented us from taking an observation of the sun; but on the 27th, though it was then cloudy, at noon, we calculated the latitude from two altitudes, and found it to be 33° 26′ N. The difference of this latitude from that which we had observed on the 25th being 2° 3′, was so much greater than could be deduced from the ship's run, marked in the log-book, as to convince the seamen that we had been set many miles to the northward by the current.

"On the 25th, at noon, the longitude, by our reckoning, was 74° W.; and I believe the computation to have been pretty just; but the soundings, together with the latitude, will determine the spot where these observations were made better than any reckoning from the eastward. The ship's run, on the 26th, from nine in the forenoon to four in the afternoon, was about 10 leagues on a N.W. by W. course: soon afterwards we hove-to in order to sound; and, finding bottom, we went very slowly all night, and till noon the next day.

"From these observations I think it may be concluded that the Gulf Stream, about the 33° of N. latitude, and the 76° of longitude W. of Greenwich, is, in the month of April, at least 6° hotter than the water of the sea through which it runs. As the heat of the sea water evidently began to increase in the evening of the 25th; and as the observations show that we were getting out of the current when I first tried the heat in the morning of the 26th, it is most probable that the ship's run, during the night, is nearly the breadth of the stream, measured obliquely across; that, as it blew a fresh breeze, could not be less than 25 leagues in fifteen hours, the distance of time between the two observations of the heat; and hence the breadth of the stream may be estimated at 20 leagues. The breadth of the Gulf of Florida, which evidently bounds the stream at its origin, appears to be 2 or 3 miles less than this, excluding the rocks and sand-banks which surround the Bahama Islands, and the shallow water that extends to a considerable distance from the coast of Florida; and the correspondence of these measures is very remarkable, since the stream, from well-known principles of hydraulics, must gradually become wider as it gets to a greater distance from the channel from whence it issues.*

"If the heat of the Gulf of Mexico were known, many curious calculations might be formed, by comparing it with that of the current. The mean heat of Spanish Town, and Kingston, in Jamaica, seems not to exceed 81°;† that of St. Domingo, on the sea-coast, may be estimated at the same, from Mons. Godin's observations;‡ but, as the coast of the continent, which bounds the gulf to the westward and southward, is probably warmer, perhaps a degree or two may be allowed for the mean temperature of the climate over the whole bay: let it be stated at 82° or 83°. Now there seems to be a great probability in the supposition, that the sea, at a certainly comparatively small distance below its surface,

* Since Sir Charles Blagden wrote on the subject, the narrowest part of the Strait of Florida has been found to be only 12 leagues in breadth.—Ed.

† *History of Jamaica*, London, 1774, vol. iii. pp. 652, 653. The different observations of the heat recorded in that work do not agree together; but those adopted here are taken from that series which appear to me the most correct.

‡ Monsieur Godin's experiments upon the pendulum were made at the Petit-Goave. They continued from the 24th of August to the 4th of September; and the average heat during that time was such as is indicated by 25° of M. de Reaumur's thermometer (see *Mém. Acad. Science*, 1735, p. 517), according to M. de Luc's calculations (see *Modifications de l'Atmosphere*, vol. i. p. 378), the 25th degree of Reaumur's *true* thermometer answers to about the 85th of Fahrenheit's; but the average heat in Jamaica, during the months of August and September, is also 85°; hence we may conclude that the mean heat for the whole year is nearly the same on the sea-coasts of both islands.

agrees in heat pretty nearly with the average temperature of the air during the whole year in that part; and hence it may be conjectured that the greatest heat of the water, as it issues out of the bay to form the stream, is about 82°,* the smallest variations of temperature on the surface not being sufficient to affect materially that of the general mass. At the tropic of Cancer I found the heat to be 77°; the stream, therefore, in its whole course from the Gulf of Florida may be supposed to have been constantly running through water from 4° to 6° colder than itself, and yet it had only lost 4° of heat, though the surrounding water, where I observed it, was 10° below the supposed original temperature of the water which forms the current. From this small diminution of the heat in a distance, probably, of 300 miles, some idea may be acquired of the vast body of fluid which sets out from the Gulf of Mexico, and of the great velocity of its motion. Numerous observations on the temperature of this stream, in every part of it, and at different seasons of the year, compared with the heat of the water in the surrounding seas, both within and without the tropic, would, I apprehend, be the best means of ascertaining its nature, and determining every material circumstance of its movements, especially if the effect of the current, in pushing ships to the northward, is carefully attended to, at the same time with the observations upon its heat."

On the 25th of September, 1777, as the ships which had transported Sir William Howe's army up Chesapeake Bay were returning toward the Delaware, with the sick and stores, they were overtaken, between Cape Charles and Cape Henlopen, by a violent gale of wind, which, after some variation, fixed ultimately at N.N.E., and continued five days without intermission. It blew so hard that we were constantly losing ground, and driving to the southward: we also, purposely, made some *easting*, to keep clear of the dangerous shoals which lie off Cape Hatteras.

On the 28th, at noon, our lat. was 36° 40′ N., and the heat of the sea, all day, about 65°. On the 29th, our lat. was 36° 2′; we had, therefore, in the course of these twenty-four hours been driven by the wind 38 nautical miles to the southward; the temperature of the sea continued at nearly 65°. Next day, the 30th, our latitude, at noon, was 35° 44′, only 18 miles farther to the southward, though, in the opinion of the seamen aboard, as well as my own, it had blown at least as hard on this as on any of the preceding days, and we had not been able to carry more sail; consequently, it may be concluded that some current had set the ship 20 miles to the northward. To know whether this was the Gulf Stream, let us consult the thermometer. At half-past nine in the forenoon of this day, the heat of the water was 76°, no less than 11° above the temperature of the sea before we came into the current.

Toward evening the wind fell, and we stood N.W. by N. close-hauled. As the sea still ran very high, and the ship scarcely went above 2 knots an hour, we did not make less than three points of leeway on this tack; the course we made good, therefore, was N.N.W., which, on the distance run by noon next day, gave us about 16 miles of *northing;* but that day, the 1st of October, our lat. was 36° 22′, 38 miles farther to the North than we had been the day before; the difference, 22 miles, must be attributed to the Gulf Stream. This, however, is only part of the effect which the current would have produced upon the ship, if we had continued in it the whole twenty-four hours: for though we were still in the stream at five o'clock in the afternoon of the 30th, as appeared by the heat of the water, being then above 75°; and, at eight in the evening, the heat being still 74°; yet, by seven the next morning, we had certainly got clear of it, the heat of the sea being then reduced to its former standard of 65°. On this occasion, therefore, we did not cross the stream; but having fallen in with it obliquely on the western side, we pushed out again on the same side, as soon as the gale abated.

These observations having been made 3° to the northward of my former ones, it is curious to observe that the heat of the Gulf Stream was 2° less. The seasons of the year, indeed, were very different; but, perhaps, under such circumstances that their effects

* The lowest calculation of the mean temperature of the gulf is preferred on this occasion, because of the constant influx of new water from the Atlantic Ocean, produced by the trade-winds; which water, not having been near any land, must, I think, be sensibly colder than that which has remained some time enclosed in the bay. On this subject, the observations made by Alexander Dalrymple, Esq., relative to the heat of the sea, near the coast of Guinea, ought to be consulted.—(See *Phil. Trans.*, vol. lxviii. p. 394, &c.)

were nearly balanced. In the latter observations the meridian altitude of the sun was less; but then a hot summer preceded them; whereas, in the former, though the sun's power was become very great, yet the winter had been past but a short time. Calculating upon this proportion, we may be led to suspect that, about the 27th degree of latitude, which is as soon as the stream has got clear of the Gulf of Florida, it begins sensibly to lose its heat from 82°, the supposed temperature of the Gulf of Mexico, and continues to lose it at the rate of 2° of Fahrenheit's scale to every 3° of latitude, with some variation, probably as the surrounding sea and the air are warmer and colder at different seasons of the year.

The preceding facts had made me very desirous of observing the heat of the Gulf Stream on my passage homeward; but a violent gale of wind, which came on two days after we had sailed from Sandy Hook, disabled every person on board, who knew how to handle a thermometer, from keeping the deck. The master of the ship, however, an intelligent man, to whom I had communicated my views, assured me that, on the second day of the gale, the water felt to him remarkably warm; we were then near the 70th degree of West longitude. This agrees very well with the common remark of seamen, who allege that they are frequently sensible of the Gulf Stream off Nantucket Shoals, a distance of more than 1,000 miles from the Gulf of Florida! According to the calculation I have before adopted, of a loss of 2° of heat for every 3° of latitude, the temperature of the Gulf Stream here would be nearly 73°; the difference of which, from 59°, the heat that I observed in the sea-water, both before and after the gale, might easily be perceived by the master of the vessel. This was in the winter season, at the end of December.

An opinion prevails among seamen, that there is something peculiar in the weather about the Gulf Stream. So far as I could judge, the heat of the air was considerably increased by it, as might be expected; but whether to a degree or extent sufficient for producing any material changes in the atmosphere, must be determined by future observations.

Perhaps other currents may be found, which, issuing from places warmer or colder than the surrounding sea, differ from it in their temperature so much as to be discovered by the thermometer. Should there be many such, this instrument will come to be ranked among the most valuable at sea; as the difficulty of ascertaining currents is well known to be one of the greatest defects in the present art of navigation.

In the mean time, I hope the observations which have been here related are sufficient to prove that, in crossing the Gulf Stream, very essential advantages may be derived from the use of the thermometer; for if the master of a ship bound to any of the southern provinces of North America will be careful to try the heat of the sea frequently, he must discover, very accurately, his entrance into the Gulf Stream by the sudden increase of the heat; and a continuance of the same experiments will show him, with equal exactness, how long he remains in it. Hence he will be always able to make a proper allowance for the number of miles that a ship is set to the northward, by multiplying the time into the velocity of the current. Though this velocity is hitherto very imperfectly known, from want of some method of determining how long the current acted upon the ships, yet all uncertainty arising from thence must soon cease, as a few experiments upon the heat of the stream, compared with the ship's run, checked by observations of the latitude, will ascertain its motion with sufficient precision. From differences in the wind, and perhaps other circumstances, it is probable that there may be some variations in the velocity of the current; and it will be curious to observe, whether these variations may not frequently be pointed out by a difference in its temperature; as the quicker the current moves, the less heat is likely to be lost, and, consequently, the hotter will the water be. In this observation, however, the season of the year must always be considered; partly, because it may, perhaps, in some degree affect the original temperature of the water in the Gulf of Mexico; but principally because the actual heat of the stream must be greater or less in proportion as the tract of the sea, through which it has flown, was warmer or colder. In winter, I should suppose that the heat of the stream itself would be rather less than in summer; but that the difference between it and the surrounding sea would be much greater; and I conceive that, in the middle of summer, though the stream had lost very little of its original heat, yet the sea might, in some parts, acquire so nearly the same temperature, so as to render it scarcely possible to distinguish, by the thermometer, when a ship entered into the current.

Besides the convenience of correcting a ship's course, by knowing how to make a proper

allowance for the distance she is set to the northward by the current, a method of determining with certainty when she enters into the Gulf Stream is attended with the further inestimable advantages of showing her place upon the ocean in the most critical situation: for, as the current sets along the coast of America, at no great distance from soundings, the mariner, when he finds this sudden increase of heat in the sea, will be warned of his approach to the coast, and will thus have timely notice to take the necessary precautions for the safety of his vessel. As the course of the Gulf Stream comes to be more accurately known, from repeated observations of the heat and latitudes, this method of determining the ship's place will be proportionably more applicable to use. And it derives additional importance from the peculiar circumstances of the American coast, which, from the mouth of the Delaware to the southernmost point of Florida, is everywhere low, and beset with frequent shoals, running out so far into the sea, that a vessel may be aground in many places where the shore is not to be distinguished even from the mast-head. The Gulf Stream, therefore, which has hitherto served only to increase the perplexities of seamen, will now, if these observations are found to be just in practice, become one of the chief means of their preservation upon that dangerous coast.

Remarks on the Gulf Stream, by Commissioner Ellicott.

We shall conclude this division with some corroborative and additional remarks, from the pen of an eminent and scientific citizen of the United States, Commissioner Andrew Ellicott. This gentleman, in allusion to the difference of temperature in the water, says, "This difference of temperature arises from the water in the stream's remaining a considerable time nearer the Equator, and then flowing with rapidity into a colder climate; and though, as it proceeds northward, it continues to lose its heat, it is, nevertheless, passing through water which still becomes colder as it advances North, so that the relative difference continues nearly the same for a great distance. The difference which I generally found between the water in the stream, and the eddy water on the coast, was about 7°.

"It has been supposed, by some ingenious writers, that, because after leaving the stream, and having soundings on our coast, and a diminution in the heat of the water, about the same time, it followed, of course, that the water on soundings and banks is always colder than the water adjoining. Though this may constantly be the case on our coast, it is probable the conclusion ought to be considered as *a particular, and not a general, one.* On our coast the stream passes nearly along the great bank of soundings: it is, therefore, very natural to suppose that, soon after leaving the stream, you will have soundings, and be in one of the large eddies on the coast, whose waters, being nearly stationary, are therefore colder than that moving with rapidity from the southward. Again, it may be observed, that the adjoining water in the Atlantic, without the stream, is also colder, as well as that on soundings; but, on the contrary, fathomless. Hence the difference in this case does not appear to depend upon the depth of the water, but upon a current setting rapidly from a warmer into a colder climate. From this a conclusion may very fairly be drawn, that *the sudden changes found in the temperature of the water in the ocean are more immediately the effect of* CURRENTS *than of* BANKS *and* SOUNDINGS;* but, as these currents are generally near coasts, and frequently occasioned by them, the thermometer may be considered a good monitor.

"It has been mentioned by Dr. Franklin, that the water of the Gulf Stream *does not sparkle in the night.* This, so far as my observations go, is incorrect: I saw little or no difference between that and the other water on the coast; but, if there was any, that of the Gulf Stream was the most sparkling and luminous. It may, however, be observed, that the same water is very different, at different times, in this respect.

"The same ingenious writer and philosopher likewise observes, that the gulf-weed is a sign of being in the stream. This is in part true, but by no means to be considered as a general rule, because *the water on the borders of the stream is constantly mixing with the adjoining water, and leaving some of the weed behind,* which consequently falls into the eddy currents, and is carried off many leagues. We meet with it on soundings, in the

* This remark has been before alluded to, see p. 241, and will be more explicitly detailed in Section vii. of the Appendix, hereafter.

eddy current, setting southerly. These remarks cannot affect the character of Dr. Franklin, either as a writer or philosopher; his character is formed of materials which will elude the destroying hand of time itself, and will be revered so long as liberty and science command the affections and esteem of mankind. I merely think the doctor was mistaken, and conceive it my duty to state facts."*

The description of, and directions for sailing through, the Gulf Stream, from the Spanish Directory, entitled, "*Derrotero de las Antillas*," &c., will be found hereafter, in the directions for ships bound to and from the West Indies.

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8. THE NEWFOUNDLAND CURRENTS.

We have shown, in a former division on the existing currents, how they set from Hudson's Strait to the eastern coast of Newfoundland, and through the Strait of Belle-Isle into the Gulf of St. Lawrence. Thus it may be seen that they also affect the western navigation of the island. Added to this, is the water brought down by the vast ebb of the River of St. Lawrence, which constantly sets down with great strength into the gulf, as shown in the Remarks on Tides, page 175. Thus is the gulf supplied with water, which can escape by the southward only. In the early part of the year, when the snows and ices are in a melting state, the outset must be considerably increased; it may, therefore, be presumed that there is in this season a considerable efflux or stream of water from the gulf, setting to the South, S.W., and south-eastward.

It appears that we have now to consider and combine—1st, the operation of the Davis's Strait Current, setting S.E., S.S.E., and E.S.E., and which winds about Newfoundland in a W.S.W. direction; 2ndly, the current which sets down the Strait of Belle-Isle, from the same stream; 3rdly, the copious ebb from the River of St. Lawrence; 4thly, a counter-current along Breton Island and Nova Scotia; and 5thly, the whirls or eddy and counter-currents which are found between the Gulf Stream and Nova Scotia.

Captain Pornton, a commander, who has long sailed in the Newfoundland trade, states that the branch of current which appears to come from Hudson's Bay always sets to the south-westward, off the eastern coast of Newfoundland; sometimes with a velocity of 2 miles an hour. Its strength, however, varies with the direction and force of the wind. Passing down the eastern coast of Newfoundland, it turns round Cape Race, and sets thence along the South side of the island, until it meets with the current from the St. Lawrence, a little to the westward of St. Peter's and Miquelon Islands. The combined action of these two currents, with that of the stream to the southward, may, perhaps, produce that *counter-current* which has been found along the inner edge of the Gulf Stream. But, be this as it may, it is very probable that it is owing to the influence of the Hudson's Bay current that so many shipwrecks happen on the South coast of Newfoundland, about Cape Pine, &c.; for ships coming from the St. Lawrence, and thence along the coast of Newfoundland, meet this current; and if it happen that they have calms, or light or head winds, it sets them imperceptibly to the westward of their reckoning: and when, supposing that they are to the eastward of Cape Race, they alter their course more to the northward, should the weather, as it often is, be foggy, they get on shore at a time when they consider themselves clear of the land.†

At times, it seems, the westerly current may extend farther than the limit above described. In a letter from a captain of the Royal Navy, dated *Breton Island*, 13th May, 1822, we have the following expressions:—"It frequently happens that a ship bound from England to Quebec strikes soundings on the Banks of Newfoundland, and shapes her course thence to pass between Cape North, on Breton Island, and Cape Ray, on Newfoundland, into the Gulf of St. Lawrence, without seeing the land, which is hid in fog: and unable to make a proper allowance for a current that sometimes runs at the rate of 4 *miles an hour*, is swept away to the westward, and runs, with a leading wind, on our iron-bound shores, when her commander fancies he is steering directly into the gulf; a misfortune that is too often announced by the bodies of the unhappy mariners, and the fragments of their vessels with which our shores are strewed.

* "Journal of And. Ellicott, late Commissioner on behalf of the United States for determining the Boundary between the United States and the Spanish Possessions," 4to, Philadelphia, 1803.

† Substance of a communication to and from the late Mr. William Heron, of Greenock.

"It should be made known that there is a settlement on Ashpé Bay, to the southward of Cape North; as from want of this information many an unfortunate seaman has perished from cold and hunger, after escaping shipwreck; and that vessels of any draught of water may safely anchor all round the island, as wind and weather may require. The soundings at half to three-quarters of a mile are 7 and 8 fathoms."*

Upon a survey of the *Virgin Rocks*, in July, 1829, the current at about 80 miles E. by S. from Cape Race, was found setting over them to the W.S.W. at the rate of a mile an hour.

The British frigate *Tweed*, on her passage to St. John's, Newfoundland, struck upon the coast near Cape Spear, and was wrecked in the night of the 5th of November, 1813. This event, most probably, was the effect of an unknown south-westerly current.

To different currents must be attributed the loss of the sloop *Comus*, the transport *Harpooner*, H.M.S. *Drake*, and the brig *Spence*, all of which were lost, at different times, upon *one spot;* the little bay, called *St. Shot's Bay*, on the South coast of Newfoundland, and lying between Cape Freels and St. Mary's Bay. The particulars of all these melancholy events have been given in our *British American Navigator*, 1843, and therefore need not be repeated. The *Comus* was from the West, and was lost in the night of the 24th of October, 1816, after having sounded, as supposed, on the inner edge of the Green Bank. The *Harpooner*, a transport, with troops, was from Quebec, and bound for London. She struck at nine p.m. of November 10th, 1816. The *Drake* sailed from Halifax for St. John's, 20th June, 1822, under very favourable circumstances, upon a direct course, for Cape Race; but on the 23rd the weather became thick, and at noon she was supposed to be 90 miles from Cape Race, but at half-past seven p.m. breakers were reported a-head, and the ship was soon after a total wreck. The *Spence* was from Richibucto, in the Gulf of St. Lawrence, with lumber, bound to Liverpool, and was totally lost at St. Shot's, at four p.m. 16th July, 1822. Another vessel, the *George Canning*, from Chaleur Bay to Aberdeen, was wrecked here, during a dense fog, on the 17th of June, 1829.

These events imperiously demand an inquiry into the causes. The five vessels, it may be seen, were all from the *westward*, and all, it may be presumed, were set to the *northward* as well as to the *westward*, of the situations which they were supposed to occupy, and the route which each intended to pursue. They can be accounted for only by the supposition of currents winding round the coast, opposing each other, and operating as above explained; for it seems clear that the westerly current from the Grand Bank so opposes the easterly one as to limit its operation *eastward*, and give it a northern inflection; thus producing the indraughts into the southern bays of the island.

It has been already shown that the waters of the St. Lawrence run off partly to the S.W., from Breton Island; so that here, likewise, allowance for a westerly set is to be made; for, as Mr. Darby has said, "On the South side of Sable Island, the *Current*, in shoal water, with prevailing South and S.W. winds, sets rapidly eastward until it reaches the end of the N.E. Bar. It then unites and blends with the *St. Lawrence Stream*, which passes the bar in a S.S.W. direction, and runs strongest in April, May, and June. I have sufficient reason for believing that the Gulf Stream, on the parallel of 42° 30′, running E.N.E., occasions the St. Lawrence Stream, then running S.S.W., to glide to westward. The strength of this stream has never been noticed, and three-fourths of the vessels lost on Sable Island have been supposed to have been to the *eastward* of the island, when, in fact, they were in the longitude of it."†

The winds hereabout have been noticed on page 133: and there can be little doubt that their irregularities produce as various changes in the currents.

NEWFOUNDLAND BANK, &c.—The navigation about and to the southward of the Newfoundland Bank, seems to require all the seaman's spirit, skill, and vigilance; for here, in particular, he may have to combat with the contending elements. This we shall show by several examples.

* See the note (2) on St. Paul's Island, p. 65; and on Lighthouses, &c., p. 69.

† The current from the gulf is commonly supposed to set south-eastward, if not checked during easterly winds and calm weather, when it runs in the contrary direction: but the winds both here and at a distance possess so powerful and irregular an action as to render the set very variable.—*Captain Bayfield.*

I.—It appears that the south-westerly current, over the Grand Bank, sets over the whole of the northern part of that bank; while the stream from the S.W. sets over the southern part, thus producing an admixture of waters from the N.E. and S.W. In a summer voyage, 1826, lat. 46° 24′, Lieutenant Hare (30th September) sounded on the outer edge of the bank, with thick blowing weather from S.W.; and, on the next day, in 45° 56′ N., and 48° 6′ W., had no bottom at 120 fathoms, with a very heavy swell from W.S.W., although he found that a current had carried him S. 67° W. 34 miles. Thus appeared, in close conjunction, a south-westerly current, with another from W.S.W., where the edges of the two entered into collision with each other.

Lieutenant Evans, in describing his run across the Atlantic, from Newfoundland, in *June*, 1828, says, "We experienced a current setting to the northward, sometimes as much as 20 miles in the twenty-four hours; this circumstance, so contrary to the generally received opinion of a *permanent* current from the North, may be accounted for satisfactorily, from the circumstance of the winds being principally from the South and S.W. A long continuance of southerly winds would have the effect of turning the fluent waters of the Florida Stream, East of the banks, to the northward and eastward, sufficient to produce the superficial current we experienced, and to check the general flow of the waters from the northward. We met no ice of any description, nor any indication of its vicinity, unless when crossing the tail of the bank; the constant southerly wind, of course will easily account for our not seeing any of these formidable dangers; but it is remarkable (and the instance is a proof of our imperfect knowledge of the theory of winds), that an American brig, making a similar run at the same time, but being about a degree or two farther North than our parallel, had to contend with strong northerly gales and to encounter numerous icebergs."

II.—Southward of the Bank.—The brig *Recovery*, Captain T. Hamlin, on her return from New Orleans toward Greenock, 21st April, 1822, was proceeding E.N.E. on the parallel of 40° toward the Grand Bank. In the first part of the twenty-four hours the weather was moderate, a breeze sprung up at West, and the vessel made all sail. In the middle part strong gales succeeded, still at West, and sail was reduced. At one a.m. black and gloomy, with rain. At five, a strong gale from the *eastward* took the ship aback, and drove her astern against the old sea; it struck the boat, and broke the larboard davit, and a new sea rising with the shift of wind, the two seas met in dreadful confusion. With a scend forward the brig dipped the jib-boom under, and broke it off in the cap; and, with the scend aft again, stove in the cabin window. While all hands were employed, trying to secure the boat, repeated seas struck her, and at length raised her above the stern, and unshipped the other davit. They then held on the tackle fall, that was fast to her, and dropped her astern, with the hope, that a favourable opportunity might occur for taking her in, but she filled and broke adrift. From five to eight the wind continued to blow a gale; sometimes at East, then at West, and back again repeatedly; while the vessel was quite unmanageable, and lying exposed to the contending elements. At eight a.m. the easterly wind prevailed, and the vessel was then laid-to under close-reefed main-topsail, &c. Latitude at noon, by account, 40° 25′, lon. 53° 0′. At one p.m. of the 22nd, it became calm: the vessel then drifted with the sea, going round and round: but, on the next day, the wind was fair at S.W., and the brig proceeded eastward.

At one a.m. on the 23rd, a sensible change in the atmosphere and sea was experienced; from which it was concluded, that the *Recovery* had entered on the Grand Bank. At daylight the colour of the water was found to be altered, and a numerous quantity of ice-birds and murrs were upon it.

On the 31st of October and 1st of November, 1822, the *Recovery*, on her return from New Orleans to London, at 3½° more to the southward, and nearly on the same meridians, met with heavy squalls, a strong gale from the N.W., and a high cross sea, which continued for nearly twenty-four hours, and to lon. 48°

Between the meridians of 52° and 47° West, 28th to 31st July, 1823, Captain Hamlin, in the ship *George IV.*, from the S.W., crossed the parallel of 40° North, all moderate and pleasant weather, with N.W. and westerly winds.

Ship *George IV.*, 3rd of April, 1824, homeward. "Squally and unsettled, with lightning: at noon, lat. 40° 14′, lon. 50° 33′. Next day, variable, with heavy showers. On the 5th, heavy showers of hail, succeeded by a smart breeze from the North. Latitude at noon, 40° 28′, lon. 46½°."

III.—Remarks from the journal of Lieutenant J. Steele Park.—"On *Monday*, 9th of

July, 1827, our latitude at noon was 40° 29′ N., and the lon. 53° 30′ W., by lunars and chronometer. The temperature of the water 73°, and the air 75°; the wind S.E. by E., a light breeze: the ship close-hauled on the starboard tack, lying N.E., by E. and going 2 knots. At five p.m. tried the water again, and found the temperature down to 67°! Hove the ship to immediately to sound, but got no bottom with 100 fathoms of line, right up and down. Nothing to be seen from the mast-head; no ice nor danger of any kind, and the temperature of the air not affected. Took altitudes for the chronometer at the same time, which made the lon. 53° 18′. We then filled and made sail again. At half-past five the water was 1° warmer, viz., 68°; at six it was 69°; at seven, 69°; at eight, 70°; at ten, 70°; and at midnight it was 71°. On Tuesday morning, at four o'clock, the water was 72°; at eight it stood at 74°; and, at noon, 74°; when the latitude and longitude were 41° 16′ N., 52° 24′ W.

" Had the atmosphere not been perfectly clear when we hove the ship to, I should have suspected that we were in the vicinity of an iceberg, but it was serene and beautiful; therefore the sudden fall of 6° of the thermometer, in this part of the ocean, must be attributed to some other cause. There is a danger of some kind laid down about this spot, by Captain Watson, of Liverpool (to say nothing of our old friend 'Daraith'). If it exists in the position assigned to it, I must have passed very close to it; indeed, I have been keeping a strict look-out for it all last night and this morning; and we have sailed over the very place where it appears in Purdy's Chart of the Atlantic. However, the water has been so remarkably smooth and unruffled, that we may have passed within a ship's length of a 'rock even with the water,' without perceiving it.

" I am inclined to believe, that we should have found the temperature of the sea below 67°, if it had been tried an hour or two sooner. We have a right to presume that it was rising when I first discovered the change; for, half-an-hour afterward, it was 68°, and it went on progressively, getting warmer and warmer, until it mounted up to 74°, and there it stopped: thus furnishing a beautiful illustration of the susceptibility, and, therefore, the usefulness, of this most simple of all instruments.

" The latitude of the ship (at five p.m. Monday) may be called 40° 36′, the lon. 53° 18′.

" *Wednesday*, July 11th.—The temperature of the water I try every four hours on ordinary occasions; and every hour, or every half hour, in approaching soundings or 'Vigiæ.' Indeed, I make use of the thermometer as an amusement. I try it sometimes half a dozen times in a watch, and a most interesting amusement it it is; more especially to sailors who navigate in the common loose random way, without a chronometer, and without any knowledge of lunars.

" Now, the temperature of the water was 74° yesterday morning at eight o'clock, and it continued nearly the same till midnight, when I found it cooling a little; it was then 71°. During the night it was neglected, and I can say nothing with certainty about the temperature; but I felt a very sensible change in the atmosphere this morning when I went on deck; and when I plunged the thermometer into the sea, I was surprised to see it down to 58°. We hove the ship to again, and passed the lead forward, but there was no bottom with 100 fathoms of line. As I knew we were only about the parallel of 42°, I did not expect soundings, but I thought it right to try, and make quite sure of the thing. The weather very fine, and nothing in sight from the mast-head. Thermometer in the shade 63°, with a southerly wind, and yesterday it was upwards of 70°. Altitudes for the chronometer were taken, when we hove-to, which made the lon. 50° 20′; and the observed latitude at noon was 42° 7′. The ship made 5′ of northing in the interval between noon and the time we tried the lead, so we must have been in 42° 2′ N., and 50° 20′ W., at eight o'clock this morning, when the water was down to 58°. At nine it was 57°; at ten, 56°; at eleven, 56°; at noon, 56°; at two p.m., 57°; at four, 58°; at eight 59°; and at midnight 60°.

" *Sunday*, July 15th.—There was very little change in the temperature of the water, from midnight of the 11th till this day at noon, in lat. 44° 17′, lon. 45° 4′. The cold has been diminishing gradually and very slowly (the atmosphere as well as the sea), but the water is now up again to 70°, and the air to 74°.

" I presume the great difference in the temperature of the ocean-water, discovered on Wednesday morning, must be ascribed to the proximity of the Grand Bank of Newfoundland; but if the generally received opinion be correct, that 'the water is' only '5° colder at the *edge* of the bank than the deep ocean,' how are we to account for a fall of 14° or 15° when we were unquestionably in very deep water, and 30 or 40 miles at least, from the

nearest soundings on the very tail of the bank? This is a problem I do not pretend to know much about, but I cannot help thinking that the Bank of Newfoundland chills the adjacent water to a greater distance than is commonly imagined.

" By-the-bye, I may notice here again (*en passant*) what I have had occasion to remark more than once before; that is, the northerly set which I have uniformly encountered near the tail of the bank. Now on the 11th, last Wednesday, the weather was beautiful; but the next day a fog, with all the density so peculiar to this part of the ocean, closed round us, and we were left to grope about in the dark, or by dead reckoning, which is the same thing. We never got a glimpse of the blue sky until this morning, when, by chronometer and excellent lunar distances, together with the sun's meridian altitude, we find out that a current has swept us N. 10° E., 54 miles in three days. I must confess my ignorance of the exact magnetic variation, but I allowed two points; which I believe is considered ample allowance in this part of the Atlantic. The latitude to-day, at noon, is 44° 17′, longitude, by chronometer and lunars, which go hand-in-hand uncommonly well, 45° 4′.

" During the three days' fog the wind was southerly; we, of course, were standing to the eastward, and I could not understand why the temperature of the sea continued so low and so nearly in the same state all the time; for, according to our calculation, we were making a great deal of easting, consequently increasing our distance from the bank: but, when it brightened up, the mystery was explained: we then discovered that the northerly current had carried the ship round the tail, on a course almost parallel to the edge of soundings; therefore the change was slow and gradual until we got beyond its influence."

Respecting the cold water which is found so far South of the tail of the Great Bank, we will give the opinion of *Mr. Redfield*, as given in the paper quoted before on p. 243:—

" From this frozen region it again emerges in the great Polar Current, covered with floating ice, which, skirting the coasts of Labrador and Newfoundland, falls in with the Gulf Stream at the southern extremity of the Grand Bank, and now becomes mainly *a subaqueous current*, the deeper portion of which can be traced only by its propelling effect on the deeply-immersed icebergs, which it forces athwart the warm tropical stream, till they become dissolved by the high temperature of the latter.

" Observations of the temperature made in sounding at various depths in the Gulf Stream, and particularly in the region where it overruns or crosses the Polar Current, would be of high interest, and of great value in estimating the dynamics of the ocean currents."

The navigator, upon this view of the current, will readily comprehend the cause of the tracts of cold water met with at times in the Gulf Stream, as mentioned on page 249; how that the temperature of the Gulf Stream fluctuates in the more eastern portions of its course; the southern progress of the icebergs and floating ice across the Gulf Stream; and, perhaps, of the origin of the south-westerly current prevalent to the southward of the Gulf Stream; which, with the prevalence and known effect of the winds, will readily account for that counter-current.

It need scarcely be remarked that these effects must necessarily vary with the season and previous weather, and that it is not to be expected that a uniform system prevails, where the elements are so varied in their tendency and force.

IV.—Temperature Eastward of the Grand Bank.—On the 29th *September*, 1826, Lieutenant Hare, in lat. 45° 38′ N., and 46° 1′ W., about 25 leagues eastward of the bank, found the temperature of the water only 59°. On the preceding day, in 44° 46′ N., and 44° 3′ W., it was 66°. On the 25th, in 45° 43′ N., and 38° 13′ W., it was 70°. On the 24th, in 46° 50′ N., and 36° 18′ W., it was 69°, with much weed. These temperatures indicate that the surface-current was from the south-westward, almost up to 47° N. in 36½° W., in the autumn of 1826; they corroborate the preceding remarks, and show that the eastern part of the stream, in this season, expands, or is impelled very much to the northward.—(See further on this subject the following remarks by Lieutenant Park, on June 28, July 2nd, 4th, and 5th, 1826.)

9. GENERAL REMARKS ON THE CURRENTS BETWEEN JAMAICA AND EUROPE.

1.—Remarks made on board the "Carshalton Park," on her Passage to London from Jamaica, in 1826, by John Steele Park, Lieut., R.N.

[The given latitude is generally that by sun's meridian altitude; and the longitude by chronometer at noon. The time is the *civil*, and not astronomical or nautical time.]

Sailed from Falmouth (Jamaica), May the 23rd, and bore away for the "Strait of Florida."

May 30th.—Rounded Cape Antonio with a gentle breeze at E.N.E. In May, 1824, I found a current here setting with considerable strength into the Mexican Sea. This voyage there is none. I have perceived no current between the Grand Cayman and the S.W. end of Cuba; but there was a little easterly set between Jamaica and the Grand Cayman. The day we called there for turtle (the 27th) it was going to windward at the rate of a mile an hour.

June 1st.—In lat. 23° 50′, lon. 84° 20′.—This day we first began to feel the influence of the current from the Mexican Sea.

It is well and truly remarked, by a skilful and a very intelligent navigator, in Purdy's *Memoir of the Atlantic*, that, "the calculations of the velocity of the Gulf Stream are not to be depended on." In the early part of June, 1824, it was running at the rate of 2¼ miles an hour between the Bemini Isles and Florida: in July, 1825, its velocity was 4 miles nearly; and this voyage it is rather more than 4. This has been ascertained by sidereal observations, made repeatedly during the night, together with the meridian altitudes of the sun and moon.

Let us now pursue our voyage. On the 7th of *June* we cleared the "Strait," and stood to the northward with an easterly wind. It has been laid down as an established (and I believe an uncontroverted) position, that a rippling of the water is never seen *in* the Gulf Stream, but only on its outer *edge*. I have no objection to receive this doctrine as a general rule; but it is certainly not an infallible indication of the edge; for I have seen it more than once in the very heart of the stream. To-day, for instance, June 9, we are in lat. 32° 10′, lon. 78° 2′, and I never saw the ocean more agitated by a current in my life.

Every now and then we get into an extraordinary boiling, like the race of a spring tide over a shoal, and by a reference to the chart it will be seen that we are very far from the outer edge. It is true, the boundaries of the Gulf Stream cannot be laid down in a chart as fixed and unchangeable: the stream will be affected, both in its breadth and velocity, by causes that we know nothing of,—causes that operate to-day, and may cease to-morrow: but there cannot be a doubt that these ripplings I speak of are in the strength of the stream, for the ship has been swept 60 miles N. 40° E. by the current in the last twenty-four hours.

June 10th.—Wind westerly; a moderate breeze; lat. 33° 51′, lon. 75° 4′.—The current has carried us 58 miles N. 56° E. in the last twenty-four hours, and we have passed through four or five ripplings to-day as well as yesterday.

June 11th.—Wind from S.W. to N.W.; a gentle breeze; lat. 34° 38′, lon. 73° 23′.—Current has set us N. 76° E. 9 miles in the last twenty-four hours. No ripple seen to-day.

June 12th.—Wind westerly; a nice little breeze.—To-day and yesterday very little gulf-weed has been seen. A spring now and then. Yesterday the current was very weak, and to-day there is none at all. On the 9th and 10th the sea was almost covered with weed, and we had then a beautiful current. It would almost appear that the weed (as well as the ripple) is but a fallacious test of this stream of streams. The truest indication is the temperature of the water. Compare the temperature of the water every four hours, and the rise or fall of the quicksilver will be a useful guide.

June 13th.—Wind from N.E. to East; a strong breeze and hazy weather; lat. 35° 34′.—No altitudes for chronometer—the sun was not out at a proper time from noon. There seems to be no northerly current. The dead reckoning agrees with the observed latitude.

June 14th.—Wind veering between North and East; a moderate breeze; lat. 36° 10′ lon. 70° 55′.—A few sprigs of weed seen now and then, and we find a little current to the N.E.

June 15th.—Light wind and very variable; between N.E. and W.N.W.—In the last twenty-four hours the current has set N. 66° E. 26 miles; a few sprigs of weed have been seen occasionally; lat. 36° 34′, lon. 70° 7′. At one p.m. got into a prodigious quantity of gulf-weed: the ocean covered with it for 2 or 3 miles. Passed through it in about half-an-hour, and during the remainder of the day saw very little: a cluster here and there, now and then.

June 16th.—Wind between N.E. and East; a fresh breeze.—The courses and distance, by compass and log, give the same easting and northing as the ship has made by celestial observations. Lat. 36° 52′, lon. 68° 45′: we still pass sprigs of gulf-weed.

June 17th.—We have been standing to the northward since yesterday morning at eight o'clock, with the wind about East, and are now in lat. 37° 50′, lon. 68° 50′, at noon. The log gives a true North course, and the chronometer gives five minutes of westing, therefore we may presume there is little or no current, for the latitude, by dead reckoning, agrees within a mile of the observation. *P.M.*—I find by altitudes, taken this afternoon at five o'clock, that the ship has made seventeen minutes of easting by chronometer since the sights I took in the morning at nine. We must be getting into the stream again, for the ship has not made a single mile of easting, by fair calculation, according to dead reckoning. A few sprigs seen to-day.

June 18th.—The wind has been steady at East all the last twenty-four hours, and we have been standing to the northward all the time. These currents of the ocean are puzzling phenomena! The true course and distance by log is N. ½ W. 50 miles; and what course do you think we have really and truly made by celestial observations? By the meridian altitude of the sun, our latitude is 38° 7′, and the longitude, by chronometer and lunar, 67° 46′. So we have made seventeen minutes of northing, whereas the run by log gives fifty minutes; and we have made sixty-four minutes of easting, when the most skilful seaman, without a knowledge of lunars or chronometer, would say we have made five or six minutes of westing. This sweep of the current I fancy we must attribute to the combined action of two streams: one, the Gulf Stream, pursuing its ordinary course to the eastward; the other, perhaps, from the St. Lawrence, running to the South. Hove a bottle overboard at noon, with our latitude and longitude, and a memorandum requesting that it might be communicated to the Secretary of the Admiralty, or to the editor of the *Memoir of the Atlantic.*

June 19th.—Southerly wind, with foggy, miserable weather. No altitudes for chronometer or latitude. By log we are in 38° 45′ N., and 66° 6′ W., at noon.

June 20th.—The same sort of weather as yesterday, with a moderate breeze from the S.S.E. By log we are in 39° 59′, and 63° 16′. *P.M.*—Passed some weed; long and stringy; not gulf-weed.

June 21st.—The wind drew round to the eastward last night, and we stood to the northward. At one a.m. the sky brightened, and I was lucky enough to get an altitude of the moon, when she was just on the meridian, which made the latitude 41° 15′; being 36 miles farther North than the latitude by account, since the observation on the 18th. Tacked and stood to the S.S.E. There has been very little current to the eastward since the longitude was ascertained on the 18th: the log gives nearly as much easting as the chronometer. Lat. 40° 59′, lon. 62° 40′. We have seen a good many clusters of gulf-weed to-day. As we approach the usual northern limit of the stream, I am watching the weed particularly to see how far we shall carry it.

June 22nd.—The wind E.N.E., blowing hard, with a high sea and dark dismal weather; but we got the meridian altitude of the sun; and also sights for the chronometer this morning at nine o'clock. The longitude was then 61° 52′, therefore we are decidedly in a fine easterly current. The log cannot possibly give a single mile of easting, for we have been lying-to, under the main-topsail, in a heavy gale of wind, all the twenty-four hours, with our head to the southward and eastward. The ship has also been carried to the North by the current: our latitude is 40° 45′. So that she has really made forty-eight minutes of easting, and only fourteen minutes of southing; and the log gives thirty-eight minutes of southing, and six minutes of westing. Making every reasonable allowance for the inaccuracy of dead-reckoning, we may safely say the current has set us upward of 40 miles in a N.E. by E. direction. No one can have less faith in dead reckoning than I have; but still it is necessary to attend to it, in order to compare it with the ship's true position: for I am not aware of any other means to determine the set and velocity of a

current, in a gale of wind, but by comparing the common calculation by log with the true place of the ship, indicated by celestial observations.

By-the-bye, it may be as well to remark here, that although my longitude by chronometer is generally reduced to noon in this journal, in accordance with the ordinary practice, a more correct way is, certainly, to reckon from the longitude when the sights are taken; for the interval between the altitudes and noon must be filled up by dead-reckoning: and if there should happen to be a current, the longitude, of course, may be affected by it. *P.M.*—At five o'clock, by chronometer, we have still a fine current. No weed seen all day.

June 23rd.—Wind E.N.E. Still blowing hard; but less sea, and wind abating. Ship's head to the S.E. Lat. 40° 1′. *P.M.*—Fine weather again. Made sail. At half-past four got altitudes for chronometer, and I am sorry to find we have lost the current. The longitude is 61° 57′. Tacked ship immediately, and stood to the northward. We have passed some weed to-day, both in large clusters and small sprigs.

June 24th.—The wind came round to the S.S.E. in the night, and we shaped a course E. by N., with a light breeze. The longitude, by chronometer, this morning at eight o'clock, disappointed me very much: at half-past four p.m., yesterday, it was 61° 57′, and we have been standing to the eastward almost all night. The log makes it 61° 18′, and the chronometer, 61° 45′! We have had a westerly set, undoubtedly; and a southerly one too, for the latitude is 40° 9′, and by the log it should be 40° 16′. A few sprigs of weed in sight to-day. *P.M.*—Chronometer (at five o'clock) gives five minutes of easting more than the run by log, since the altitudes in the morning at eight.

June 25th.—Wind South: a gentle breeze and fine weather. Lat. 40° 18′, lon. 60° 8′. No perceptible current these last twenty-four hours. Passed several sprigs of weed.

June 26th.—Wind southerly, a steady 6-knot breeze and fine weather. Steering E. by S. Lat. 41° 3′, lon. 56° 46′.—Ship has gone 138 miles by log, and 155 by chronometer. The difference between chronometer and dead-reckoning must not always be attributed to a current. Some allowance must be made for the carelessness of sailors (especially in the night watches) at the helm, and other circumstances relating to the run by log. However, I think I am warranted in saying we have benefited something by a current. I make it N.E. by E. 10 or 12 miles. *P.M.*—The chronometer tells me (at six o'clock) that we have an easterly current.

June 27th.—A moderate breeze at S.W. Running E. by S. Lat. 41° 27′, lon., by lunars and chronometer, which differ very little, 53° 41′ at noon. Current has set us N. 62° E. 26 miles in the last twenty-four hours. *P.M.*—Two sprigs of gulf-weed this afternoon, in lat. 41° 29′, lon. 53° 8′.

June 28th.—Steering E. by S. with a gentle 4-knot breeze at S.W.—The longitude by chronometer was 52° 11′ this morning, and we made eleven minutes by log between that time and noon. So we shall call the longitude 52° 0′, and the latitude 41° 50′. We have had a little northerly set these last twenty-four hours, 8 or 9 miles North, and 2 or 3 miles East. I have observed, in my last three voyages from Jamaica, that we have always felt a northerly current of some strength in this part of the ocean, setting toward the Bank of Newfoundland, in June and July. This, if I mistake not, is contrary to the generally received opinion. Some weed in sight to-day; a few sprigs decidedly gulf-weed: they had all the well-known characteristics of the regular gulf-weed; but there was some of a different kind, with long stringy stems.

June 29th.—A light breeze from the southward, with foggy "*Bank weather*," as the sailors call it. Steering E. by S. At eight o'clock this morning it cleared away, and I took altitudes for my chronometer, which made the longitude 49° 42′; and, at the same time, we discovered an island on the starboard beam, 3 or 4 miles off. Shortened sail, hove the ship to, and sent the mate to see what it really was; for, although I had no doubt of its being an iceberg, yet it certainly looked something like land; and I did not wish to leave it in any kind of uncertainty. The fog, which had cleared away at eight o'clock, and left a beautiful blue sky, returned suddenly when the boat was about halfway from the ship. The mate, an active, skilful seaman, had a compass with him, and he apprehended no danger; but pushed on for the island, instead of returning, when he saw the fog spreading. Hour after hour passed away, and no appearance of the boat. Night came on, dark as the grave, with a cold, benumbing drizzle, and a fog so dense that we could scarcely see across the deck. My grand object was to keep the ship as near the

same spot as possible. All day and all night we kept the bell tolling, and fired a great gun occasionally: a tar barrel was also blazing at the main-yard arm, but all was unavailing. I shall never forget the terrors of that night. I reproached myself as the cause of their destruction; and I prayed most earnestly for daylight and clear weather. I thought daylight would never come; but it came at last, and the fog was thicker, if possible, than the day before. The most sanguine now began to despair. About five o'clock something was heard, like the blowing of a conch shell, but so faint and indistinct that we thought it was only the echo of the great noise we were making on board. However, it was soon discovered that the sound was coming nearer and nearer: but, as no person on board knew that they had a shell in the boat, we were still in a sad state of anxiety: for it might, perhaps, be a ship sounding her shell in the fog, as usual at sea. In a few minutes the plash of oars was heard, and in five minutes more the boat was alongside, with all hands safe and sound, thank God! but cold and hungry enough. The mate tells me he rowed round the iceberg, which he thinks was about 300 feet in length, 150 feet in breadth, and 40 or 50 feet above the surface of the water. It was melting away rapidly: streams of water were gushing down its sides, and they had only got a few yards from it, on their return, when (to use his own words) "it took a sally and fell over on its beam ends." Our last sight of the ice, when bearing S.W. 3 or 4 miles, was in lat. 42° 13′, lon. 49° 44′.*

June 30th.—Light breeze from the westward. When the boat returned this morning, made sail again on the same course, E. by S. At noon, atmosphere thick as melted butter. No sights for chronometer or latitude, and I was in too much distress to attend to latitude or longitude by dead-reckoning.

July 1st.—Westerly wind, with thick fog generally, but clearing away now and then during the day, so that I got a glimpse of the sun this morning for the chronometer, and also a good meridian altitude for the latitude. I was even lucky enough to get three sets of lunar distances. I worked them all separately, as well as by the mean of the three sets, and they differed only 2 miles. The lunar is sixteen minutes to the eastward of the chronometer, but I rely more on the chronometer than the lunar. Lat. 42° 46′, chronometer, 47° 11′, at nine a.m. Immediately after noon the fog returned with all its density.

July 2nd.—Wind westerly. Light breeze; 3 or 4 knots.—In confirmation of my position, that a ship makes more northing than the log will give, near the Bank of Newfoundland, in this season of the year (my remarks have been made in June and July only), I find we have made 28 or 30 miles of northing more than the dead-reckoning can account for satisfactorily since noon yesterday. The water is smooth, and we have been steering one course, E. by S. ½ S., with a fair wind: by log we have gone 82 miles, and I think the ship has been attended to as carefully as one can expect in a merchantman. The chronometer also gives more easting than the run by a very great deal. It cleared up about twelve o'clock, and gave me the meridian altitude: lat. 43° 31′. And it brightened again at three p.m., when my chronometer gave 44° 6′. The current is unquestionably going to the northward and eastward. I make it N. 61° E., 48 or 50 miles, since nine o'clock yesterday, when the longitude was found by chronometer.

July 3rd.—Steering E. by S. ½ S. Wind westerly, a nice little steady breeze.—Longitude, by chronometer, this morning, at twenty-four minutes past eight, was 41° 44′; and the latitude 43° 58′. Current had set us N. 73° E. 17 or 18 miles in the last twenty-four hours.

July 4th.—Wind westerly, a beautiful breeze. Running E. by S. ½ S.—It is my constant practice to take sight for the longitude two, three, or four times a day, according to circumstances, as well as sidereal observations, for the latitude in the night watches; and by these means I think it is a fair conclusion, that I can discover, generally, the set and velocity of a current very soon after the ship begins to feel its influence. Now, as the current has been setting altogether to the eastward during the last twenty-four hours (N. 85° E. 10 miles), the longitude only will be disturbed, therefore the chronometer will be our truest guide, and she tells me that the current ceased in lat. 44° 16′, lon. 38° 32′. This I call the eastern boundary, or rather the termination, of the Florida Stream; and under that impression I turned a bottle adrift with a memorandum: some curious and perhaps useful knowledge, relating to the currents of the ocean may possibly

* On the 18th of June, 1839, an iceberg was seen, supposed to be about a mile in length, and from 50 to 70 feet high, in lat. 40° 50′ N., and lon. 48° 39′ W.—(*Naut. Mag., Nov.,* 1839.)

result from experiments of this kind. I dare say I have tried it fifty times, but I never heard of any of my bottles being found. I saw some bunches of weed to-day; it was decidedly what is commonly called gulf-weed, the same kind that we met with in the Florida Stream, along the coast of North America, but it had not the same flourishing look. I call them bunches, in contradistinction to sprigs; for the sprigs that we fall in with to the southward float lightly on the surface, but those to the northward are more like bunches of oakum—bunches of oakum saturated with water, and almost sinking.

July 5th.—Wind W.N.W. A fine steady breeze. Running E. by S. ½ S. Lat. 44° 53′, lon. 35° 45′. I have no doubt that the weed mentioned yesterday was at the eastern end of the stream, for we have seen none since, and none was seen for two days before; and the run, by log, gives now as much longitude as the chronometer. I fancy we may presume that the weed was carried there by the Florida current, unless, indeed, we adopt the hypothesis, that the current has nothing to do with it: that it grows and ripens at the bottom of the sea; and, when in a state of decay, the stems are broken off by the agitation of the water, or some other accidental cause, and then it comes to the surface. Be that as it may, the weed, in this part of the ocean, I have invariably found in a perishing state; and I have generally found it fresh and healthy in the stream sweeping along the coast of America.—(*See the description of the* SARGASSO SEA *hereafter.*)

[From the 6th to the 14th of July, when the ship arrived at the Lizard, the Journal presents nothing remarkable, excepting a current setting N.W. by W. on the edge of soundings. The current on other days was scarcely perceptible.]

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10. ON THE GENERAL CAUSES OF THE CURRENTS, ETC.

"It is well known how easily a current may be induced by the action of the wind, and how a strong S.W., a N.W., or even a N.E. wind, on our own coasts, raises the tide to an extraordinary height in the English Channel, the River Thames, the East Coast of Britain, &c., as those winds respectively prevail. The late ingenious Mr. Smeaton ascertained, by experiment, that in a canal of 4 miles in length, the water was kept up 4 inches higher at one end than at the other, merely by the action of the wind along the canal. The Baltic is kept up 2 feet at least by a strong N.W. wind of any continuance; and the Caspian Sea is higher, by several feet, at either end, as a strong northerly or southerly wind prevails. It is likewise known, that a large piece of water, 10 miles broad, and generally only 3 feet deep, has, by a strong wind, had its waters driven to one side, and sustained so as to become 6 feet deep, while the windward side was laid dry. Therefore, as water pent up so that it cannot escape acquires a higher level, so, in a place where it can escape, the same operation produces a current, and this current will extend to a greater or less distance, according to the force by which it is produced or kept up by the wind."*

These facts are so well ascertained, that it may generally be taken for granted, a certain degree of current will obtain on the Atlantic, after a continuance of any uniform wind, where the sea would be otherwise in a placid state, and unaffected by other causes. For it is supposed that the winds, where uniform and permanent, produce currents equally uniform and permanent. Hence it is that the winds between the tropics, having a general course westward, protrude the water of the Atlantic in the same direction, and cause the flow of a current the same way, unless where it meets with land, islands, or

* Major Rennell, on the Thwart Channel current. It has furthermore been noticed, that the effect of wind in altering the level of the surface of water is strongly exemplified in the reach which forms the summit-level of the Forth and Clyde Canal in Scotland. This each is about 18 miles long, nearly in a straight line, East and West. When a westerly gale has blown for some time, the action of the wind sweeps away the water from the West end, sinking its surface, and accumulating it at the East end, where it escapes over the lock-gates, in a stream sometimes 10 inches deep.—*Ed. Ph. Journ.*, vol. vi. p. 71.

In a gale of wind, in 1823, a part, or *reach*, of the *Grand Junction Canal*, was raised 21 inches.

The effect of S.W. and southerly winds, on the level of the sea upon the coast of Guinea, has been shown on page 174.

shoals, to obstruct its course or change its direction, or where it runs through channels which draw it a different way.

There is reason for believing that the great currents within the torrid zone are increased by the influence of the moon, which draws them on from East to West. One instance that currents are affected by this cause is, that in the Faro, or Strait of Messina, between Sicily and Calabria, in the Mediterranean Sea, where there is *neither rise nor fall*, a current sets to the northward and southward alternately, for six hours, having every appearance of being governed solely by the lunar influence. Other instances might be given; and there is little doubt but the power of the winds is blended with the attraction of the moon in forming the currents which set westerly from the Atlantic into the West Indian Sea.*

Another feature of ocean currents has been elicited in the experiments made under the direction of the hydrographic department of the United States' Coast Survey (to whose labours we have had occasion to allude in other places), and that is, that the set of the submarine currents *does not correspond either in velocity or direction* with those of the surface. How far such a singular fact will overturn our preconceived notions, it must be left for more extended remarks to elicit. The following is the account given by Lieutenant Walsh, of the U.S. brig *Taney*, the officer alluded to.

"The surface current was first tried by the usual mode (a heavy iron kettle being lowered from a boat to the depth of 80 fathoms); then, for the trial of the under current, a large *chip-log*, of the usual quadrantal form, the arc of it measuring full 4 feet, and heavily loaded with lead to make it sink and keep upright, was lowered by a light but strong cod line to the depth of 126 fathoms (the length of the line); a barrega was attached as a float, and a log line fastened to this barrega; and the rate of motion of this float, as measured by this log line and glass, as well as the direction, as shown by a compass, were assumed as the velocity and set of the under current. No allowance was made for the drag of the barrega, which was always in a different direction from the surface current. It was wonderful, indeed, to see this barrega move off against wind and sea, and surface current, at the rate of over one knot an hour, as was generally the case, and on one occasion as much as 1¾ knots. The men in the boat could not repress exclamations of surprise, for it really appeared as if some monster of the deep had hold of the weight below, and was walking off with it. I will cite from the log several instances of these experiments.

"On *May* 11th, 1850, in lat. 24° 43′ N., lon. 65° 25′ W., we found a surface current of one-third knot per hour, setting to the West, and an under current, at the depth of 126 fathoms, of one knot, setting W.S.W.; temperature of water at surface, 77° 3′; at 50 fathoms, 77° 5′; at 100 fathoms, 73° 5′. The current felt by the vessel on that day (as deduced from the comparison of the true position obtained by astronomical observations and chronometers, with those by dead reckoning) agreed with this trial of the surface current, being the same within a fraction, viz., 0·3 knots westerly. On this day the sea was covered with a species of medusæ, of a dark red colour, spherical in shape, from one-eighth to three-eighths of an inch in diameter.

"On *May* 12th, at four p.m., in lat. 25° 55′ N., lon. 64° 43′ W., the surface current was found to be one-third knot, setting N.N.E., and the under current (at 126 fathoms) 1¾ knots, setting S.E., being the strong under current I have alluded to; this was well ascertained by several trials; temperature of water at surface, 75°; at 50 fathoms, 76°; at 100 fathoms, 69°. From this time, four p.m. to eight a.m. the following morning, we experienced a strong current of 1·3 knots per hour, setting N. 14° E., as determined by the observations. While trying the currents in the boat, all hands remaining on board the schooner were employed sounding with 500 fathoms line, but failed to get the temperature at that depth, there being at that time too much swell.

"On *May* 13th, at half-past five p.m., in lat. 26° 42′ N., lon. 64° 4′ W., the surface current was found to be one-third knot, setting E. by S.; the under current (at 126 fathoms) 1¼ knots, setting W.S.W.; at the same time obtained the following temperatures: at

* Particular convulsions in the interior of the earth sometimes occasion an extraordinary derangement of the tide, &c. After a late occurrence of this nature in the Mediterranean Sea, called by the Italians a *sea-earthquake*, the course of the tides in the Gulf of Spezzia was totally deranged for the seven or eight succeeding days. But the ebb and flood were sensibly perceived at intervals of a quarter of an hour, half an hour, and an hour, during that whole space of time.

surface, 77° 5′; at 50 fathoms, 76° 5′; at 100 fathoms, 74° 5′; at 500 fathoms, 53° The current felt by the schooner, in the interval between eight a.m. and four p.m., w a easterly 0·4 knot per hour, agreeing with the trial in the boat.

"On *May* 14th, in lat. 26° 46′ N., lon. 63° 53′ W., found a slight surface drift, too small to be measured, setting to the westward, and an under current (at 126 fathoms) of 1¼ knots, setting N. by E. No current had been acting on the vessel for the preceding sixteen hours, and dead reckoning agreeing with observations. On this day the sea being pretty smooth, we tried soundings with the wire, and got 1,050 fathoms without bottom, and we succeeded in getting, by one of Six's self-registering thermometers (which came up uninjured by the immense pressure) the temperature at that great depth, which was at 49°, while at the surface it was 77°.

"On *May* 18th, at nine a.m., in lat. 36° 6′ N., lon. 67° 56′ W., found a surface current of one-third knot setting N. W. by N., and a very slight under current (at 126 fathoms) not more than one-sixth knot, setting N.E. No current was felt by the vessel during that day, but during the preceding night one-fourth knot per hour, setting N.W. Being calm and pretty smooth, we sounded during this day to the depth of 2,050 fathoms, when the wire broke without reaching bottom. The temperature, at the surface, 70°; at 100 fathoms, 65°. The trial of currents on this day was one of the two occasions which I have alluded to, on which we found a less under current than that above it.

"On *May* 29th, at eleven a.m., in lat. 33° 58′ N., lon. 72° W., found the surface current one-third knot, setting S.E., and an under current (at 126 fathoms) of one knot, setting W.N.W. Temperature at surface, 71°; at 50 fathoms, 70·5°; at 100 fathoms, 67°. We were set during this day, as determined by the afternoon observations, to the eastward, at the rate of one-half knot per hour. On this, which happened to be the last occasion of these experiments, I tried the current at the depth to which the kettle was lowered (80 fathoms), which it would have been better always to have done; I found it tended in the same direction as that at 126 fathoms (counter to the surface current), but at so small a rate, that it could hardly be measured, not more than one-tenth knot per hour, the float moving at only this small rate, being but one-tenth of the velocity at which it had moved just before, when trying it at 126 fathoms. This indicates that the kettle had just penetrated the under current; and thus, by this means, it would appear practicable to measure the depth of the surface current, or its point of contact with the counter under current. Such experiments in the *Gulf Stream* would be particularly interesting."

With our present imperfect acquaintance with this important branch of the subject of currents, it would be useless to build up any argument. We shall therefore dismiss it for the present, leaving it for the seaman to add to our store of knowledge hereafter.

In the year 1804, Captain James Manderson, of the Royal Navy, published "An Examination into the True Cause of the Stream of Florida," &c. In this treatise he considers the floods of the Mississippi as the "prime mover of the Florida Stream;" and he presumes that it is caused by the waters which fall into the Gulf from that and other rivers. Captain Livingston, on the subject, says—"From the best information I could obtain, relative to the quantity of water discharged into the sea by the Mississippi, Rio Bravo, &c., there seems no probability that, in the aggregate, they exceed a three-thousandth part of the water which is discharged through the Strait, between the Florida Reefs and the Bemini Kays, or the narrowest part of the strait."*

Upon the hypothesis of Captain Manderson it was subsequently stated, in an American work, that the velocity of the Gulf Stream might be calculated by the *rise and fall of the floods in the Mississippi*. Thus is one error propagated upon another! "I have," adds Captain Livingston, "experience of the contrary. In August, 1818, the River Mississippi was *uncommonly low*, and I never saw the Gulf Stream run with greater velocity. The trade-winds raising the level of the Gulf of Mexico seem to me the principal cause of the Gulf Stream.

* Captain *White* has argued, at considerable length, against attributing the origin of the Gulf Stream to the Mississippi. But it would seem to us to be decided in very few words. The *turbid* and *fresh* waters of the river, its volume, and its fluctuations, are all incompatible with the facts of the Gulf Stream. Again: arguing from analogy, in what part of the world do we find a *river* preserving an independent current across an ocean, and which can be recognised at 3,000 *miles from its source?* The effects of all rivers are utterly insignificant when compared with this.—Ed.

"I am of opinion that its velocity depends on the motion of the sun in the ecliptic, and the influence he has upon the waters of the Atlantic; as, when the sun's declination is North, the N.E. trade-wind blows fresher, and extends farther to the northward, than when the sun's declination is South. This causes a greater pressure of water toward the Caribbean Sea, and a superior elevation of the surface of the Gulf of Mexico, the superfluous water of which escapes by the Strait of Florida, where it is least opposed by the trade-wind, which only affects it laterally (except in the short distance between the Dry Tortugas and the Salt Kay Bank), and even there the effects of the trade-wind must be very much diminished by the Bahama Bank, with the islands and kays thereon.

"There can be little doubt that the attraction of the sun, while in the northern hemisphere, influences the current which generally prevails about Madeira, and causes it to set with greater velocity toward the southward and eastward. One well-known fact seems to corroborate this idea, namely, that the above-mentioned current is always much stronger in the summer than in the winter months. On a reference to my journals it appears, that although we were a considerable time in the limits over which the influence of the Gulf Stream generally extends, in the forenoon of Friday, the 19th, and on the whole of the 20th of February, we felt its effects in a slight degree only, the water appearing during that time to have been perfectly stationary. It may also be remarked, from the journals of my voyage through the Strait of Florida, in September, 1818, in the ship *Asia*, and in March, 1819, in the brig *Dispatch*, how very little we gained, in the latter instance, from the assistance of the stream, when compared with the manner in which it hurried us to the northward on the former. All this tends to confirm me in the opinion that the velocity of the Gulf Stream depends almost entirely on the sun's place in the ecliptic."—*A. L.*

It may here be remarked, that the Gulf Stream is augmented during the *rainy* season of the West Indies, and reaches its highest parallel (about 43° N. between 56° and 57° W.) in the summer only. In that season it there spreads *over* a vast extent of oceanic water. It is also to be recollected that in the same rainy season the waters of the Caribbean Sea, which is then surcharged, seek an escape along the Colombian coast to the *eastward*, as well as by the Channel of Yucatan to the West.

The Easterly Currents in the *Northern parts of the Atlantic*, and which in the Bay of Biscay exert their tremendous effects so as to be proverbial, originate in the North, as we have described, and then conform to the winds, which in these regions are, as already shown, mostly from the N.W., and violent during a great part of the year.

The more general prevalence of westerly winds off the coasts of the United States operate to produce a depression of the water off those coasts, and of course contribute to an easterly tendency in the waters of the ocean.

The indraught into the Strait of Gibraltar is attributed to the evaporation of the Mediterranean Sea, which appears to be the cause of the currents setting immediately in that direction, and of biassing the water from the West.*

These circumstances, combined, must indisputably produce the set or drift of a great portion of the Atlantic to the East, E.S.E., and S.E., which, however, varies with the winds, with the seasons, and local circumstances.

The auxiliary winds on the African coast are the mean of continuing and carrying it down that coast in the manner in which it has been described.

To the prevalence of westerly winds and easterly currents is to be attributed the shorter period of voyages from America to Europe than from Europe to America; a fact established by general experience.

At any considerable distance from the coast of America, the easterly current caused by the action of violent West or N.W. winds is seldom felt to the southward of latitude 36°; consequently, the sea about the Bermudas, and thence southward, is free from the influence of this current. The currents here, though slow, are produced in the direction of the wind, particularly when it is of long continuance. These currents are found stronger near the islands and rocks of Bermudas than at a distance, because the obstruc-

* This was the opinion of Dr. Halley, which has been controverted by those who suppose that the effect may be accounted for by the motion of an under current, setting outward. The flood-tide, on either side of the strait, does certainly set outward, but the ebb sets inward with the general current. See the remarks on the tide of the strait, page 173. The easterly indraught appears to commence at about 100 leagues West from the mouth of the strait.—See, upon this subject, our *New Sailing Directory for the Mediterranean Sea.*

tion which the water meets with from the islands causes it to run proportionably faster past their sides. In a brisk gale the current here has been experienced from 12 to 18 miles in the twenty-four hours, in the direction of the wind; at other times, when the wind was not settled, no current has been found.

Major Rennell is of opinion that those transient and contradictory currents that are met with in the mid-ocean are owing to gales of wind, which sometimes are but narrow in their column of air, but affect the surface very strongly so far as they extend.

The system of ocean currents having, from the numerous observations before related, amidst a crowd of others, become tolerably well arranged and understood, may be readily comprehended, although it must not be considered that we have nothing more to learn upon the subject.

A great addition to Hydrography has been laid before the world by the United States' Government, the result of the Exploring Expedition, under the orders of Captain *Charles Wilkes.* This fine work, in five volumes, reflects the greatest credit both on the promulgators and on those who have so successfully carried out the multifarious objects for which the expedition was intended. From that work we extract the views of its author concerning the Hydrology of the North Atlantic.

"The approach of the Gulf Stream to our shores (United States) has been ascribed to the influence of N.E. winds. These are known to affect the tides in our bays and harbours; but I am unwilling to admit that these are an adequate cause for the change in position and velocity of so great a body of water. The action is far too trivial to account for such an effect. It is certain, on the other hand, that the Gulf and Labrador Streams both owe their existence to the unequal distribution of temperature on the earth's surface; there must be a difference in the intensity of the causes that act, to produce these effects at different seasons of the year; and it may be inferred that the changes of the seasons act unequally upon the two streams. The force of the portion of the Labrador Current which follows the coast of the United States will, when superior, carry the Gulf Stream outwards, and when that force diminishes, the Gulf Stream will approach more nearly to the coast, and most nearly when its own relative force is the greatest. Whatever be the ultimate causes of the streams, it would appear that their approximate causes are influenced by temperature, the Gulf Stream being increased in mass and velocity when the temperature is highest, and the Labrador Stream when it is lowest; and in conformity we find it a general impression that the former is broader and more rapid in the summer of our climate than in winter. I must, however, state, that I have been unable from my own personal observation, either by the thermometer or the set of the vessel, to distinguish this increase of the Gulf Stream in summer. Thus, in my passage to England, in August, 1836, from the time we passed to the East of George's Bank, in a latitude about 1° to the South of it, we experienced a low temperature in the water, and the vessel was retarded. We were, therefore, in the Labrador Current.

"After the squadron had crossed the Gulf Stream we experienced little action from current till we reached Madeira, the whole difference between our dead-reckoning and the true place of the ship being no more than 175 miles in twenty-six days.

"Before leaving this part of our subject it may be as well to refer to facts familiarly known, but which did not come within the scope of our observations. The stream known on our coast by the epithet of gulf, may often be traced upon the surface, but with diminished velocity, entirely across the Atlantic; throwing, at some seasons, the seeds and drift of tropical climates upon the British Islands, even as far North as the Shetlands. At other times, when the Gulf Stream ceases to flow, or is overpowered by the great Polar Current, they are carried by the latter to the S.E., on the coast of Spain and Portugal, which current has been so disastrous by the number of vessels that have been wrecked on Cape Finisterre, where it divides, one branch of it passing around the shores of the Bay of Biscay, along the western coast of France, and thence crossing the English Channel, which is now so well known as the Rennell Current, while the main Polar Stream flows South, along the coast of Portugal, towards Madeira, with a diminished velocity, as a surface current.

"That the stream which sets upon Cape Finisterre is the origin of the Rennell Current, the following remarks by Horsburgh clearly show:—'The current is found to set East from March to November, particularly when West winds prevail; and off Cape Finisterre, and near the southern part of the Bay of Biscay, it sets mostly along the coast

to the East; and along the East coast of the Bay it sets to the North, parallel to the West coast of France.'

"At Madeira and the Canary Islands the surface Polar Stream seems to have ceased; but by our observations on the deep-sea temperature a *submarine stream* still appears to exist. In lieu of the former, we have the current familiarly known as the African Current, by its causing so many distressing wrecks on that coast, and to which attention has often been drawn by the captivity and cruel slavery to which their crews have been subjected.

"As has been seen in the narrative, but little surface current was found on our voyage from Madeira to the Cape de Verdes; but the submarine stream was still found, as was shown by the low temperature of the deep-sea soundings. At, and in the neighbourhood of, the latter islands, and between them and Cape Verde, on the African coast, a strong surface current is felt. In endeavouring to account for this remarkable circumstance of the creation of a current, and its increased velocity, of which every navigator must be aware, when in the neighbourhood of many islands, and the effects of which we have often experienced in our long voyage, I shall now advert to the cause which, I think, is quite sufficient for the effect; and that is, the accumulation of water caused by the obstructions that islands offer to the onward flow of submarine streams, thus raising the level of the ocean in their vicinity, and consequently a tendency to run off, and thereby create a current where none was perceptible before, or an increased velocity in that which was felt.

"To this cause, then, I believe the currents around the Cape Verde Islands owe their origin, as well as all others prevailing near islands and banks; and, as corroborative proof of this, I will mention the fact, that, where no submarine Polar Stream exists, permanent currents are not found. This will, I trust, be amply shown in the sequel.

"That remarkable current along the coast of Guinea, from which it derives its name, passing Cape Palmas, and flowing into the Bight of Benin, I attribute to the same cause. This current is in the immediate vicinity of the Equatorial Stream, but runs in an opposite direction, and for a long distance parallel to it.

"This Guinea current is lost in the Bight of Benin, near Prince's Island, which lies under the Equator, in the longitude of 7° E.; and it is confined and obstructed by a southern Polar stream, much in the same manner as the Labrador is affected by the Gulf Stream on the coast of the United States, and which is supposed to be lost near Cape Hatteras.

"Beyond the Cape de Verdes, overfalls, rips, and a continual tendency to change in the surface of the ocean, are experienced, as if two great conflicting submarine currents were meeting at some depth beneath the surface.

"As we proceeded on our route from Porto Praya to Rio Janeiro, the same appearances continued; but we did not meet the Equatorial stream until we had crossed the Equator and reached the latitude of 3° S., and longitude 25° W. It was then pursuing its course towards the coast of Brazil, whence, passing between the Windward Isles, it finally enters the Gulf of Mexico.

"This part of our passage afforded many interesting observations, exhibiting extended rips, and the boilings above spoken of, alternating with smooth spaces, and variable currents, setting for a short time in one direction, and immediately afterwards in the opposite. All spoke of a conflict of currents, and a forcible mingling of the waters beneath the surface. From Porto Praya to Rio we were influenced by currents 280 miles, N. 41° W.

"No current of the velocity here mentioned has ever been experienced to the East. To what is this sudden increase and rapid flow to be imputed? or, to what other cause can it be imputed, but to a submarine stream, flowing directly on the shoal coast of Brazil, and raising the level of the ocean on those banks which it endeavours constantly to restore, by flowing off rapidly in the opposite direction?

"Before proceeding into the South Atlantic, I will recapitulate our results in the northern.

"Beginning at the Equator, we find a great surface stream setting to the West, across the ocean, which, passing along the coast of Brasil, enters through the Windward Island Passages into the Caribbean Sea, and thence into the Gulf of Mexico, whence the water flows into the Gulf Stream, which, although at first narrow, soon spreads itself, crosses the

Atlantic, and expands its force in mid-ocean, or, at times, upon the British Isles. This great stream, of moderate temperature on the open ocean under the Equator, becomes more heated on the coast of Brasil; and opposite the coast of the United States retains, both in summer and winter, a temperature approaching to, or often exceeding, 80°. In the meantime, another great stream sets South along the coasts of Labrador and Newfoundland; and dividing at the banks, a branch of this follows the line of soundings off Nova Scotia and the United States, while another flows beneath the waters of the Gulf Stream, passes South, and mingles with the waters of the ocean, and affects the surface temperature where it comes in contact with islands and banks. The uninterrupted flow of this vast Polar Stream is along the coast of Portugal and Spain, and a small part of it flows into the Bay of Biscay, caused by its striking upon Cape Finisterre, and forms eventually the Rennell Current: another part flows into the Mediterranean, in consequence of the higher level of the stream, when compared with the waters of that sea. The main branch now pursues its course on the surface, until Madeira and the Canaries are reached in its course, beyond which it is no longer apparent. But below the surface, as shown by the low temperature of the deep-sea soundings, a submarine stream pursues its way to the Equator, where the waters again commence the same round as before.

"In the South portion of the space included within the above limits, is an expanse of water which presents remarkable phenomena. This is called by the name of the Sargasso Sea, and is noted for the quantity of the aquatic plant, known as the gulf-weed (*fucus natans*), that is found in it. The general impression seems to be, that this space is occupied by a sort of eddy, in which is deposited all matter borne by the different currents of the ocean, and that to this cause is due the accumulation of gulf-weed. It would, however, appear, that this idea cannot be correct; for, in the first place, the weed appears fresher there than when drifting in the Gulf Stream and other currents, and it is, therefore, nearer the place of its growth; then, again, there is no evidence that any drift-wood or other terrestrial production, is found in the Sargasso Sea; and in the third place, the currents that have already been spoken of, appear rather to set from it, thus indicating that it has a higher level than other parts of the ocean. That such difference of level has a physical cause, there can be no reasonable question."

At some future day we may be in possession of a sufficient number of facts relative to the set of the currents, both surface and submarine, throughout all the oceans, upon which to deduce a system; at present we can only surmise when facts are deficient: and the few observations which have been made out of the beaten track only tend to subvert many of our preconceived notions. We have before alluded, page 234, to the observations made under the superintendence of the U.S. Coast Survey, by Lieutenants C. H. Davis, G. Bache, S. Lee, and R. Bache, in 1845—48, upon the submarine temperatures of the Gulf Stream. These facts, combined with the deep sea soundings which have been made throughout the Mexican Sea and the Strait of Florida, place the Gulf Stream in a somewhat new light.

Lieutenant Maury, in discussing these observations, and combining them with his former theories, infers that the warm waters of the Gulf Stream *actually run up hill* from the Narrows off the Bemini Isles to Cape Hatteras; that its upper surface is convex, as might reasonably be supposed from the velocity being greatest in the axis of the stream, and that the tendency of any body afloat on it is therefore to bear to its sides, and this accounts for the presence of the gulf-weed on its *margins*; that the *cold* waters on the West and North serve as walls to *confine* this warm river—a physical feature of the different conditions of the different portions of the ocean, which have no tendency to assimilate. But, apart from reasoning founded on theoretical assumption, we have the singular fact of the submarine currents between Bermuda and Porto Rico moving in almost opposite directions to that on the surface, and that, too, not in one constant or uniform direction, but varying greatly in its rate and direction on consecutive days. This feature certainly will render the subject of the general circulation of the oceanic waters one more difficult to be understood; and we must have multiplied observations ere we can arrive at any satisfactory conclusion on the subject. But as to the surface currents, those which most interest the seaman, we can define with something approaching to certainty.

Most willingly would we give here, *in extenso*, an excellent paper with which we have been favoured by Captain R. Leighton, on the general system of ocean currents, but space will only allow a brief notice of it. Captain Leighton, from his own observations,

aided by the remarks of others, traces in a more connected manner than has hitherto been done the progress of circulation in the ocean waters, as follows:—

The amount of rain which falls in the Gulf of Mexico and the basin of the Mississippi River cannot be the source of the Gulf Stream; for although there is a wet and dry season in the West Indies, yet the amount of rain which falls there is a mere sprinkling compared with the deluges of rain that fall in the whole of the countries surrounding the Bay of Bengal during the S.W. monsoon, which may be judged of by the fact that the average annual fall of rain at Maulmain, in six years, was 15 feet; and at Tavoy it was 16 feet, and it sometimes rains for six weeks without cessation at Maulmain. In the Mexican Gulf the great Mississippi is almost the only river of great magnitude; but what is this compared with the Ganges, the Irawadi, the Sittang, and the Selween Rivers, all falling into the N.E. part of the Bay of Bengal? Now, from this cause, and from the N.E. monsoon driving the current along the West coast of Sumatra, and the S.E. trade hemming the water into the Bay of Bengal, the only outlet for these influxes of fresh water would be the Straits of Malacca; and if the argument of fresh waters giving rise to the Gulf Stream or other currents held good, the Strait of Malacca would be an unnavigable torrent: but it is not; therefore the natural inference is, that the Gulf Stream is a continuance of the great tropical current.

Captain Leighton argues that the trade-winds are the great motive power of the currents; that the winds outside the tropics may, by their variableness, counteract each other, but the effect of wind is well exemplified in the effects it has in retarding the flood tides. The general features of the monsoons and the trade and passage winds, all tend to throw light on the movements of the surface waters, and may be reconciled with those actions.

Considering these circumstances, the Indian Ocean, southward of Timor, appears well adapted to form the head-quarters of a great tropical current nearly surrounding the globe, and found under the various names of the Equatorial currents of the Pacific Ocean —the drift current of the Indian Ocean—and the Agulhas current round the Cape of Good Hope, where it gives the best proof of its being a great and deep-seated current, by its following the windings of the Algulhas bank, in 60 fathoms water. We have it again in the Atlantic Ocean (where it gives rise to two circular currents), and it is here called the Equatorial current—and again, the drift current of the Caribbean Sea—and, lastly, in the North Atlantic, as the Gulf Stream.

Captain Leighton then proceeds to trace an unbroken current from the Indian Ocean to the North Atlantic, by his observations made during a single voyage, as follows:—

Bark *Secret* to Calcutta, 1850, November 4th, in lat. 23° S., lon. 78° 0′ E., to November 15th, in lat. 6° 11′ S., and lon. 84° 7′ E., time eleven days, the currents were *N.* 71° *W.*, *true;* and the distance, 138 miles.

Bark *Secret* from Maulmain, 1851, June 21st, in lat. 8° 22′ S., and lon 85° E., to July 8th, in lat. 28¼° S., lon. 44° E., the currents ran *N.* 82° *W.*, *true;* and the distance 216 miles in seventeen days.

From July 8th to the 17th, in lat. 32¼° S., lon. 32° E., time nine days, and the currents *S.* 86° *W.*, *true;* distance 52 miles.

From July 17th to August 5th, in lat. 33° 46′ S., lon. 15° 16′ E. (bad weather in a series of five rotary gales round the Cape of Good Hope), time nineteen days, and the currents *S.* 66° *W.*, *true;* distance 354 miles, or averaging 19 miles per day.

From August 5th to August 21st, at St. Helena, time sixteen days, currents *N.* 58° *W.*, *true;* and the distance 175 miles.

From August 22nd, at St. Helena, to September 7th, in lat. 3° 23′ N., lon. 23° 48′ W., time sixteen days, the currents *N.* 72° *W.*, *true;* and the distance 241 miles.

There is thus manifestly a continuous current traced by this voyage from the borders of the Eastern Archipelago to the well-known tropical current of the North Atlantic. The paper then proceeds to trace this current across the Atlantic into the Mexican Gulf, where its final exit in the Gulf Stream proves that this latter is a prolongation of the great tropical current, which nearly encircles the earth.

In our recent "Directory for the Pacific Ocean" (1851, Part II., p. 1238) we have described the tropical currents of that great ocean, and demonstrated that this great westerly drift becomes broken up and enters the Oriental Archipelago through the

numerous channels dividing the islands, and thus becomes neutralized as to its westward set. We might therefore suppose that the open spaces in this archipelago will have a generally higher temperature than the rest of the ocean, and also be, as above argued, the initial point of the great current systems which circulate around the Indian and Atlantic Oceans.

The tendency of the waters in the North Atlantic certainly seem to be a circulation *around* the central portions known as the Sargasso Sea. We do not require the supposition of Major Rennell, that this is a hollow, or depression of the surface, *into* which the currents run on all sides; nor that of Lieutenant Wilkes, that it is a raised *area*. This phenomenon of the waters revolving around a central quiet space is also well exemplified in the basin of the North Pacific on a magnificent scale; it is less so, but equally clear, in the area of the North Sea. It is true that the southward tendency of the Arctic waters in the Labrador current, across the Newfoundland Bank, is to break in upon this uniform circulatory movement, still it is sufficiently symmetrical to form a feature in the great movement of the waters.

There is another current whose origin is involved in some obscurity; it is the Guinea current. It is, certainly, partly due to the prolongation of the African current from the N.W., but, by analogy, we should suppose that it would recurve to the westward when it got fairly within the scope of the trade-winds and consequent tropical drift.

Captain Leighton argues that it is a continuation of the central current, which, after passing between the Sargasso Sea and the Bermudas, turns to the south-eastward towards and into the Gulf of Guinea, blending with the current from the North and eastward. This appears feasible, but what is this easterly current?

In the "Pacific Directory," 1851, pp. 1243—1247, there is an *easterly* current described, which extends entirely across the Pacific between the latitudes of 4° and 10° N. This remarkable current would seem to be the effect of the Equatorial calms; or, rather, that the water, being driven by the N.E. and S.E. trades, is here heaped up, as it were, and not being able to reflow *over* the adjacent drifts, like the aerial currents, assumes the form of a counter-current.

The question arises, Is there a similar current in the Atlantic Ocean? By analogy we might reply in the affirmative. But the configuration of the land, and the greater interferences that the currents have from each other, renders this fact less evident. Nevertheless, it may be fairly assumed that some portion of the Guinea current is due to an Equatorial counter-current, which would set directly along the African coast into the Bights of Benin and Beafra, as the Pacific counter-current sets into the Bay of Panama.

IV.—OF PASSAGES OVER THE ATLANTIC.

GENERAL REMARKS.

In the preceding pages we have described those natural phenomena of winds, currents, &c., which govern the track of a ship across the ocean. The object of the present section is, to apply these principles to the seaman's practice; but, previous to entering upon this portion of the task, we will make a few general observations upon great circle sailing, which is now being revived as a *new* subject, when in fact it is one which was among the first principles recognised in navigation. This is not the place to enter into disquisitions on the working of great circle problems—that must be left to works specially devoted to nautical mathematics. The excellent "Practice of Navigation," by Lieutenant Raper, or Towson's Tables, published by the Hydrographic Office, will be found excellent guides; but still a greater simplicity in the application to ordinary purposes of navigation is a great desideratum, and one which, perhaps, we shall endeavour to supply at a future day.

Great circle sailing was known and acted on very early in the history of navigation. It is more than probable that Cabot, Columbus, Magalhaens, and all the first great navigators, were acquainted with the subject;* but this, it must be remembered, was

* It is alluded to, directly, in a work by Pedro Nunez, in 1537; again, by Pedro de Medina, in 1545; but his system was erroneous, and was corrected by Martine Cortes (or Curtes), whose work, "The Arte of Navigation," was soon after, in 1561, translated out of the Spanish into English, by Richard Eden, and was long the text book of British seamen. Numerous other works, in which it is correctly and distinctly described, afterwards appeared, as one by

prior to the knowledge of the principles of finding the longitude. When Gerhard Mercator, in 1569, published a universal map, on the projection now known by his name, a new era commenced in navigation; but its true principles were not correctly described till they were done so by Edw. Wright, in 1599. In this projection, as is well known, the meridians being parallel to each other, and straight lines, the latitude is distorted and increased in proportion as these meridians are more distant from each other than the correct difference of longitude would give for that latitude. Consequently a straight line drawn between any two points on such a plane chart, will give the correct compass bearing, which, if maintained throughout the course by a ship, will lead her from one point to the other. This course is well known as the rhumb course, and is that in universal use from its simplicity. But it is *not the shortest course*, except it be due East or West on the Equator, or North or South on a meridian, which are great circles. This course, developed on a sphere, is found to be a *spiral*, and is considerably removed from a great circle or shortest distance if a great extent of longitude is traversed by it. We need not pursue this subject, but an example will well explain its application.

From a point off the Lizard, in lat. 50° N., lon. 5° 30′ W., to Cape St. John's, in the Bay of Notre Dame, in Newfoundland, also in lat. 50° N., and lon. 55° 30′, the course, *true*, is of course *West*, and the distance on this parallel is 1,928¼ miles. But if a ship were to quit the Lizard on a *N.* 70° 20′ 30″ *W.* (*true*) course, and then gradually bearing more westward, attaining the latitude of 50° 45′ N., in lon. 30° 30′ W., thence bearing more southward, and approaching Cape St. John's on a similar angle to the parallel that she had left the Lizard, she will have sailed over 1,893 miles, or 35¼ less than on the parallel; but, in her greatest separation, she will have been 165 miles distant from the rhumb course. Therefore, if she were to take any course between this great circle course and the parallel of 50°, she would have a less distance to traverse; and this is the great advantage which the great circle sailing offers—that of a wide range of choice (in a higher latitude) without increasing the distance.

Further, if she were to assume a course as much higher in latitude as the great circle course is above the rhumb, she will find that it will be of the same length as the latter. Thus, in the example cited, if on leaving the Lizard she were to bear away for a point in lat. 55° 30′ N., lon. 30° 30′, and then approach Cape St. John's, such a curve will be found to be exactly 1,928¼ miles in length, and yet be, in its maximum separation, 330 miles apart from the parallel. The advantage of such a range of choice will appear subsequently, in the remarks upon the transatlantic passages.

The great difficulties in application of the principle of great circle sailing to practice are, the laborious nature of the calculations, now, however, much reduced, and the inference as to how a course so much at variance with that which the chart will apparently dictate as the most direct, will place a ship in respect to favourable winds or currents. Still the scope it allows to the navigator must be considered as no mean advantage, even if its shorter distance may not be an inducement to rigorously follow out its principles.

1. OF SHIPS BOUND TO AND FROM THE EAST INDIES, ETC.

M. D'Après de Mannevillette, in his Directions for Navigating from the English Channel to the East Indies, says, "When you steer out of the channel, you ought to shape your course so as to pass Cape Finisterre at the distance of 25 or 30 leagues: this distance," he adds, "will be sufficient, in whatsoever season of the year your voyage may happen: you may, indeed, double that cape still nearer, if circumstances require; but, from its latitude, you should always shape a course for the Island of Madeira.

"Though a sight of that island is not indispensably necessary in this passage, it is proper, however, to gain a sight of that, or of the Island of Forto Santo, that you may be able to keep on your course afterward with greater certainty, whether you pass between the Canary Islands, or leave them to the eastward, as may be judged most convenient."

Michael Coignet, of Antwerp, in 1581; an excellent work by Roderick Zamarano, in 1585, &c. That by this time it was thoroughly recognised is evident by a work by John Davis, published in August, 1594, called "The Seaman's Secrets; wherein is Taught the *Three* Kinds of Sayling—Horizontall, Paradoxall, and *Sayling upon a Great Circle*." It is also described in Richard Polter's "Pathway to Perfect Sayling," about the same time. After this it is found in most of the old works on navigation.

The reason of doubling Cape Finisterre at the before-mentioned distance is, that you may not be embayed by wind or currents within the Bay of Biscay. The distance, in rounding the cape, may be from 20 to 50 leagues. With a westerly wind, give it sufficient offing; or, in hazy blowing weather, it may be dangerous to stand to the southward in the night.

Gales from W.N.W. have frequently continued to blow into the bay for several days successively. Several outward-bound East Indiamen have been driven far into it, in April and May; and, should a ship in this situation lose her masts, and be driven on a lee shore, the consequence would be dreadful.

Modern navigators who have chronometers prefer passing to the westward of Madeira, instead of steering for that island, at any convenient distance, beyond 7 or 8 leagues. Thus they generally have steadier winds; particularly in winter. In November, December, and January, westerly gales prevail here, which produce eddy winds and severe squalls near the land, occasioned by the high land's obstructing the regular course of the gales; and, besides, the weather here is very precarious.

M. D'Après goes on:—"In the passage from the coasts of France to the Canaries, you may frequently find differences in your reckoning to the eastward, which arise most probably from the indraught of the currents toward the Strait of Gibraltar: some have made the land on the coast of Africa when they expected to have discovered Tenerife; others have gained sight of Allegranza, off the northern part of Lanzarote, instead of Tenerife; and, though the errors in reckoning may not frequently be so considerable, yet it is safer to be on your guard, when you judge, by your reckoning, that you are in the latitude of these islands, especially in the night-time, or when the want of moonlight, or very thick hazy weather, prevents you from discovering dangers at such a distance as to be able to escape them.

"The differences to westward, though much more rare, are yet not without example; chiefly when the winds have hung contrary for some time after the departure from the ports of England or France.

"Ships are, however, now generally recommended to pass to the westward of the Canary and Cape Verde Islands: it having been found, that, in this route, steadier winds may be expected than those generally prevalent close to or among the islands. On the African coast, W.S.W. and S.W. winds are frequent. The track now generally adopted, by ships having chronometers, is that to the westward of all the islands.

"Should it be required to touch at Senegal or Goree, the best course will be, to make the coast of Africa near Cape Blanco, lat. 20° 55′; as there are soundings at 5 or 6 leagues off the coast, and no danger in making the land, either by day or night, provided the lead be kept frequently going: and thus you may steer up to the cape.*

"Though it may seem natural enough not to suspect any errors of consequence in your reckoning in so short a passage as from the Canaries to the Isles of Cape Verde, yet there are instances of such, as well to easting as to westing. It is with respect to errors in our westings, that I advise all vessels to keep 30 leagues to windward of Bonavista, before they stand in to make the land; lest, in keeping a direct course for that island, they should pass between the Isle of St. Nicholas and the Isle of Sal; and, finding themselves to westward of Bonavista, when they reckoned themselves to be still to eastward of it, they should miss their refreshments at the Isle of St. Iago, an accident which has happened to several vessels.

"The making of these islands is often difficult, occasioned by the fogs which hang frequently around them. For this reason, those who come from the northward, ought to steer their vessels in this track with all possible precaution.†

"The most convenient course for vessels, which continue their voyage from the Canaries, without touching at the Islands of Cape Verde or Goree, is to steer, after they lose sight of the Canaries, so as to pass about 45 leagues west of Cape Blanco, or near the meridian of 20°); from this position they will make good their course due South, as far as to 12° N., and afterward S.E. by S., till they meet with those variable winds which succeed to the trade-winds. By this they will keep the mid-channel between the islands

* Directions for proceeding hence, southward, will be found in the next section.

† See remarks on the rocks supposed to lie to the eastward of Bonavista, in the Directions for the Cape Verde Islands, hereafter.

and Cape Verde, and coast along the bank below that cape, at a sufficient distance, even though they should make an error in their reckoning of 15 or 20 leagues to eastward."—(*But see Major Rennell's Remarks, page* 207.)

But as, when the sun is near the northern tropic, the trade-wind has been often found to fail within sight of the Cape Verde Islands, it has been recommended to ships, at these times, to pass the islands to the westward, at the distance of about 10 leagues, in order to preserve a steady wind, and prevent delay, by keeping clear of the light eddy winds, which then prevail near and among the islands. When to the southward of these isles steer to the S.E., so as to get between the meridians of 18° and 23° W., upon losing the N.E. trade-wind. Should the southerly winds then commence, advantage may be taken of the shifts to stand on the tack which will gain most to the southward, and so as to cross the Equator between the longitudes above mentioned, if the winds will permit. Be cautious of making a long tack, either eastward or westward, with a dead southerly wind, in hope of having a better, unless the wind should veer, so as to produce much southing.

The S.E. trade-wind, at its northern limit, generally inclines far to the southward, particularly in July, August, and September, but frequently in other months. A ship meeting this trade, should not be kept too close to the wind, but keep clean full, in order to make good way to the S.W., and clear of the southern limits of the westerly current that generally prevails about the Equator.

It has been already shown, in the description of currents, that ships, passing the line too far to the *westward*, run the risk of not being able to weather the coast of Brasil. But *M. D'Aprés* has observed, that there is not one instance to prove that, by passing the Line to the *eastward* of the limits above mentioned, ships meet with calms of a long duration, and currents setting with great rapidity toward the River Gaboon, as had before been generally imagined. His opinion has been corroborated by *M. la Pérouse*, whose remarks on the subject are heretofore noticed.—(Page 119.)

M. D'Aprés adds, "Vessels which sail from St. Iago, should steer S.E. as far as the 12th degree of latitude: after that S.E. by S. Those which depart from Goree should steer S.S.W., if they desire to keep clear of the coast, till they reach the parallel of 10 degrees; thence their course should be S.E. by S."

His words on crossing the Line are, "When the variable winds succeed the trade-winds, the best method of crossing the Line with speed is, to take advantage of the very first variable winds, for gaining the ordinary track of the general winds so soon as you possibly can; and for this end, to keep indifferently to that tack which bears most to southward, without troubling yourself about crossing the line at any determinate point, lest you make your voyage longer than is necessary."

Captain *Geo. Cheveley* has said, "I think July may be considered as the worst month of any to get quickly across the Line to the southward. I sailed from Liverpool two summer voyages in succession; the one in 25, the other in 30 days, to the Equator. I then lost the N.E. trade in 11° and 12° N., and experienced for three weeks nothing but S.W. winds, blowing hard squalls, and gales of wind, with torrents of rain; with which I had also to contend against a strong northerly current (the Equatorial) of at least a mile an hour."—See the Description of Currents, page 217.

In a subsequent communication, Captain *Cheveley* says:—"I will now endeavour to illustrate this assertion by extracts from my journal and observations, during my passage out to India, in the ship *Ganges*, of Liverpool. I sailed from England on the 17th of June, 1844. Experienced hard gales from S.W., for eight or ten days, in the chops of the Channel, succeeded by light variable winds and calms, which held on till the 7th of July, when we passed the meridian of Madeira. Were abreast of the Cape Verdes on the 16th, and on the 17th entirely lost the N.E. trade in lat. 14° North, and lon. 25° West, which all along had been weak and variable.

From abreast of Palma (Canaries) to St. Antonio (Cape Verdes), I found on this voyage a steady current of ½ to ¾ of a mile an hour, setting to the N.E., which corroborates my observations of 1830 (Memoir, page 190), and I found, that the further I was to the eastward, the stronger was the set of current. I have tried many experiments on the currents from the Cape Verdes to the Equator, and have endeavoured, as hinted at by Mr. Purdy. in some measure to account for the changes and seasons of change. In October, 1836, I found the current commencing at North and N.N.W., to lat. 9° or 10° N.,

and from thence to the Equator, S.W., ⅛ to ¼ of a mile an hour; increasing gradually as I proceeded South, in the same direction, to 1 mile an hour.

"This leads me to suppose there is a regular change of season with respect to the eastern branch of the Equatorial current; and from much attention to this very important subject, combined with actual trials of the direction and velocity of the currents in different months of the year, something of the following nature has suggested itself to my mind:—

"June, July, August—Current strongest to N.N.W. and N.E.

"September, October, and November—Changing gradually in course and velocity.

"December, January, February—Strongest to N.N.E., and round to S.W.

"March, April, May—Again changing gradually in course and velocity.

"Thus, I should say, July strongest to N.N.E. and N.E.; October weakest and changing; January strongest, N.N.W. to S.W.; April weakest and again changing.

"This is, of course, in a measure theoretical, but also assisted by some labour and practice."—(*Geo. Cheveley.*)

Capt. Sir Edward Belcher, in his outward voyage round the Cape of Good Hope, in the *Samarang*, March, 1843, diverged from the "beaten track," with considerable advantage. His reason for so doing was, that by crossing the Equator 10° or 15° more eastward than is usually done, when arrived in the parallel of St. Helena, he would be many miles to windward of the usual route. "Having always considered the eastern route the preferable, I attempted, on my homeward voyage, in H.M.S. *Sulphur*, to reach Porto Praya direct from Ascension. In this, however, I failed, owing to the occurrence of westerly breezes driving us toward the African coast, until in the parallel of the Cape de Verde Islands, which proved that from the Cape de Verdes southerly towards the Equator in the month of June favourable breezes without calms might be reckoned upon; and I was reminded that ships coming from Ascension and St. Helena generally make good passages, passing to the westward of the Cape de Verdes. My experience, whilst employed on the African Station, taught me that a fair passage from the Cape de Verdes to Sierra Leone or the coast easterly, could always be anticipated, and that no retarding calms are to be met with on the verge of the African soundings. Vessels also from the African coast, seeking Ascension for change of climate, find this remark applicable, and it might be fairly assumed that if we could reach the Equator under light airs and moderate breezes in a less number of days than the average passage to the twenty-fourth degree of West longitude (the increased distance being impeded by many days calm), and by crossing to the eastward of the tenth degree of West longitude, the westerly current would be avoided, and we should be able to fetch to windward of Ascension, or possibly sight St. Helena, many hundred miles to windward of the "beaten track." The result proved as was anticipated. Leaving Porto Praya on March 7th, we experienced light and moderate breezes, with *south-easterly current.* Between the 7th and 21st of March, or from Porto Praya to the Equator on the ninth meridian of West longitude, we averaged 81 miles per day, and experienced no more than ten hours calm. Before the south-westerly breezes quitted us, we had been carried as far as 8° West. After light south-westerly airs, we were enabled, on the 28th of March, by a succession of breezes from the S.E., to pass 150 miles to windward of Ascension, in 9° 44′ E, arriving in Simon's Bay, Cape of Good Hope, on April 25th."—*Voyage of the Samarang*, pp. 7, 8.

ON THE RETURN TOWARD ENGLAND, the Equator should be crossed between the meridians of 18° and 25°. When the sun is to the northward of the Line, the longitudes of 21° to 23° are to be preferred; because then light and variable winds extend far from the African coast, especially in July, August, and September, when the sun is returning from the northward.

If the southerly winds become light, a North, or N. by W. course may be kept, in order to reach the N.E. trade-wind as soon as possible; but, if variable light breezes are prevalent far to the northward, you should endeavour to pass the Cape Verde Islands at the distance of between 40 and 50 leagues.

In crossing the N.E. trade-wind, a ship's sails should be kept well filled, to enable her to gain speedily to the northward. In this tract the Sargasso or gulf-weeds will be met with, which are described hereafter, as existing in the SARGASSO SEA, and which are sometimes found as high as 41° N.—(*See page* 208.)

Beyond the northern limit of the trade-wind, ships generally cross the parallel of 32° N. in from 39° to 42° W.

Should the wind vere to the N.W. on approaching toward the Azores, you may pass through one of the channels of these islands, and thence pursue a course to the English Channel, according to circumstances.

It is not always advisable to pass to the eastward of these islands, because adverse winds often prevail from the northward between them and the coast of Portugal; and the currents are, also, generally unfavourable to this route; yet it has sometimes happened, that ships passing this way have, with S.W. and West winds, reached the Channel sooner than those which have proceeded to the westward. With these S.W. and westerly winds, you must be cautious in approaching the Channel, in case the current should prevail, which sometimes sets athwart it, as described in a preceding division of this work.—(*See pages* 180 to 193.)

REMARKS by M. KRUSENSTERN.—We shall now introduce, by way of illustration, Admiral Krusenstern's description of his route from the parallel of the Cape Verde Islands to the Equator, on his voyage around the world, in November, 1803, with that of his re-crossing the Line on his return in May, 1806.

"The passage to the westward of the Cape Verde Islands certainly deserve the preference over that to the eastward: as experience has shown to all navigators, that, to the westward, a fresh trade-wind prevails, while to the eastward there are frequent calms. Indeed, very few examples exist of navigators sailing between the Cape Verde Islands and the coast of the continent. I therefore recommend to all those who, on their passage to the Equator, take the westward course, to steer in such a direction from the Canary Islands, as to cross the parallel of 17° (or that of the Island of St. Antonio) in 26½°, or even in the 27th degree of longitude; and then to steer S.E. by S. directly to the Equator. They will thus entirely avoid these islands, which are of sufficient magnitude to alter the direction of the trade-wind, and it frequently happens that S.W. winds are met with here. Even if this should not be the case, the wind is always very moderate in their vicinity, and it cannot impede much to steer a degree and a half more to the West than a direct course, when it is with the certainty of keeping a steady wind.

"If, however, it be necessary to have a sight of St. Antonio, in order to correct the ship's reckoning, this may be done at the distance of 30 miles. At all events, especial care must be taken not to come within 20 or 25 miles of it; as there is otherwise the risk of being driven, either by storms or by calms, too near the land.

"When I was going to India, in the year 1797, on board the English line-of-battle ship, *Raisonable*, we experienced the danger of sailing too near this island; and, even in this voyage, were made aware of its vicinity: for, in the night previous to our seeing St. Antonio, it suddenly became calm; but, so soon as we withdrew from the land, the wind freshened. Although we had lost sight of the island, and were in 27 degrees of longitude, the wind blew very moderately from the South and East. I waited now, with impatience, for the true N.E. trade-wind, that I might return to the eastward, which I proposed to do for about 20°, in order to keep clear of the southerly winds and strong easterly currents, which are found in the region between the N.E. and S.E. trade-winds; and I wished, too, not to cross the Line more to the westward than the 24th or 25th degree of longitude.

"Ships have been driven, when crossing the Line, to the westward of the 24th or 25th degree, by strong currents, and a wind too southerly, so near to the coast of Brasil as not to be able to clear Cape St. Augustin. If the wind, however, will allow the passage of the Line in 20° or 21°, a ship should not fail to do so, as she will then have the advantage of a wind directly free, so soon as the S.E. trade sets in; and will, of course, advance quicker to the southward. This, however, is rarely possible.*

* But see the preceding remarks, particularly those of *M. La Pérouse.*—Mr. Luccock, in his *Notes* on Brasil, has said, "After passing the Cape Verde Islands, the mariner who is bound to the southward (for Brasil) feels anxious about crossing the Line. With a good chronometer on board, I should run boldly on toward the American coast, being careful only to avoid falling to leeward of Cape St. Roque, and into the heavy current which sets close around it. Without a chronometer, or knowledge enough to use it with advantage, I should allow, from 17 degrees of North latitude, a westerly drift, beginning with 5 miles for twenty-four hours, increasing the allowance until the latitude of 5° be obtained, when it should

"Our naturalists made several experiments to-day, to ascertain the cause of the sparkling of the sea, the result of which seemed to prove that it is not merely occasioned by the motion of the water, but is, in fact, produced by little organized beings. They took a dish, over which they spread a fine cloth, doubled, and poured the water on it, as it was taken out of the sea. It then appeared that several spots remained on the cloth, which glistened as soon as it was shaken, while the water which had passed through it did not seem in the least impregnated with phosphorus, although mixed with sawdust to replace the want of the matter which was now separated from it, and might have been supposed to have given the sparkle to the water when in motion. Dr. Langsdorff, who examined these fiery bodies with a microscope, and has made drawings of several of them, found them to be, particularly the larger ones, in the form of crabs; and in the small ones he observed fibres, evidently denoting organization.—(*See more on this subject in the Description of the Canary Islands hereafter.*)

"On the 10th of November, in lat. 13° 51′ N., and lon. 27° 7′ W., we fell in with the N.E. trade-wind. It was still, however, considerably to the eastward: namely, E. by N. and E.N.E. We held, therefore, as much as we were able, to the S.E.; and this was the more necessary, as we had to work against a strong current, which threw us back nearly 20 miles a day. On the 15th, at noon, when we were in lat. 6° 58′ N., and lon. 21° 30′ W., the whole sky became overcast. About two we had some rain, and a squall of wind that continued with considerable violence during two hours. Throughout the night it was very thick, with little wind. We now found ourselves on the borders of the trade-wind, which, after this squall, we had entirely lost, and entered into the region where are found unsettled, and, for the most part, directly contrary, winds, calms, or violent squalls, accompanied by heavy showers, and a hot damp air, as oppressive as it is injurious to health. Several days passed in which we did not get sight of the sun, so that the men could dry neither their clothes nor bedding. I had not, however, a single invalid during the whole of that time. Every possible precaution, indeed, was adopted: I had fires lighted three or four times a week in the hold, which were kept in during several hours, and which is, undoubtedly, an excellent method of drying and purifying the air. At Tenerife, I had laid in such a stock of citrons, potatoes, and pumpkins, that our supply was not exhausted, even on our arrival at St. Catharine's. Instead of brandy, I gave the men a pint of the best Tenerife wine; and, in the morning and evening, some weak punch, made very sweet, with a good deal of citron juice in it. We availed ourselves of every moment of sunshine to dry and air the clothes and bedding. The constant rain, during which we caught water enough for a fortnight, gave our people a good opportunity of washing their clothes; and I had an awning spread, entirely for their use, between the fore and main masts, where they also washed each other.

"This disagreeable heavy weather continued during ten days; in which time we had advanced only about 2° to the southward; for we had to struggle against a very strong current, that drove us back daily about 15 or 18 miles. At the end of the 10 days we had again a fresh North wind, which lasted nearly twenty-four hours, when it veered to the S.E., and settled in that quarter as the true trade-wind. We were now in lat. 2° N., and lon. 23° W.

"On the 26th of November, we crossed the Equator at about eleven a.m., in lon. 24° 20′ W., after a passage of thirty days from Santa Cruz, Tenerife. Under a salute of eleven guns we drank the health of the Emperor (Alexander I.), in whose glorious reign the Russian flag first waved in the southern hemisphere.

"I now directed my course toward the Island of Trinidad; the wind was, however, so much from the southword, and the current, at the same time, set so strong to the West,* that we had crossed the meridian of Trinidad in 7° of South latitude. The wind soon freshened, and became more easterly, so that we made a rapid advance, and steered as much to the southward as it would permit. The westerly current, indeed, still flowed; but it had much less force than at the Equator. In 14° S. we lost the S.E. trade-wind, and had easterly winds, which, by degrees, veered to N. and N.W. During the whole

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be, at least, 20 miles a day. From that parallel to 13° South, the drift will decrease, and then again become variable."

* The direction of the currents from the Equator to the 8th degree of South latitude was S.W. by W. and W.S.W., running from 26 to 35 miles a day.

time that the trade-wind lasted we were accompanied by an infinite number of bonitos, and harpooned some of them almost daily. They made a fresh and palatable dish for our people."

On the Return toward Europe, 21st of May, 1806,* at three in the afternoon, the commodore re-crossed the Line, in lon. 22° 18′ 30″ W.; and he says:—

"The passage on the Line in this longitude, or even more to the westward, on the homeward voyage to Europe, is not attended with any loss of time; for, even by running so much to the westward, a few degrees in so long a voyage cannot make any difference, and experience has shown, that the winds in this direction are fresher; while more to the eastward there are frequent calms, and it is of itself a sufficient advantage to remain as short a time as possible in the unwholesome regions about the Equator. I have, indeed, the authority of D'Aprés against me: but, in all probability, he thought more of a direct course than of the health of his crew.

"We found the Variation of the Compass, on the day of our crossing the Line, by several sets of good azimuths, in the morning, 12° 8′ 45″, and in the evening, 12° 7′ 15″ W. In the year 1795, Captain Vancouver found it on the Line, in the meridian of 21° 35′, = 9° 20′ W., which proves an addition of 2¾° in the space of eleven years.† On my return from China in 1799, the variation here was found to be 11° 33′; and, in 1764, Mr. Nicholson found it on the Line, in the longitude of 20° 40′, = 7° 56′, so that the variation of the magnetic needle in these seas is evidently increasing. This seems also to be proved by every known observation; and there is no part of the world where they can be made at sea with more accuracy than in the regions of the S.E. trade-winds, between the Cape of Good Hope and the Equator, the sea being constantly calm, and the weather mild and beautiful.—(1806.)

"On the 22nd of May, in the 5th degree of North latitude, and 23rd of longitude, the sea, with a fresh breeze from the southward, was very strongly illuminated during the whole night; more, indeed, than we had seen it in all the course of our voyage. The waves communicated their brightness to the sails, and the whole ocean appeared wrapped in flame. In the year 1792 the same circumstance was observed, precisely in this part, by Captain Garnault, of the *Ganges*.

"We did not fall in with the N.E. trade-wind until the 29th of May, when we reached lat. 6° 37′ N. Hitherto we had experienced the unpleasant weather that usually prevails in the regions between the Equator and the N.E. and S.E. trade-winds."

We shall conclude this part of the subject with the remarks of Captain *Martin White*,‡ upon the proper longitude for crossing the Equator, by vessels bound to the Cape or Indian Ocean, and it will be seen that he recommended a more easterly meridian than those previously given.

"Vessels bound into the Indian Ocean, or to the Cape, or to the Islands of St. Helena or Ascension, should steer so as to cross the Line, if possible, between 10° and 15° West; by so doing, they will not only avoid the strong north-westerly set of the Equatorial Current, but may be pretty certain of fetching into the vicinity of Ascension, and of weathering Brasilian Trinidad, as the S.E. trade will generally be met with, either upon

* Two days before, viz., on the 19th, at five in the evening, "we saw, in lat. 2° 43′ S., and lon. 20° 35′ W., in the direction of N.N.W., and at the distance of about 12 or 15 miles, a singular phenomenon, but which, owing to the lateness of the day, we were unable to examine sufficiently close to ascertain the nature of it. A cloud of smoke arose to about the height of a ship's mast; disappeared suddenly; then rose again, and vanished entirely. It could not be a waterspout, nor a ship on fire, as some persons on board conceived, for the smoke rose much too high; and Dr. Horner was of opinion, that if the whole was not an ocular deception, occasioned by a peculiar refraction of the rays of light, it had all the appearance of a volcanic eruption, and was possibly the forerunner of some island."

This instance, in connexion with several others, which are cited in the *Ethiopic Memoir*, pp. 80 to 83, prove the existence of a tract of submarine volcanic action, or perhaps a volcanic upheaving of the bed of the ocean. As stated in the work above mentioned, it is an interesting field for observation for the mariner, and one well worthy of his attention when crossing the Line in these longitudes.—Edit.

† Experience, however, shows, that the different results cannot be considered as an absolute proof.—Edit.

‡ Remarks on the Winds, the Tides, and the Currents of the Ocean, &c., p. 153.

the Equator, or very soon after crossing it; and for the same reason, when leaving the southern hemisphere for the northern, vessels should endeavour to cross the Line between the longitudes of 22° and 26° West, because they will find both wind and current in their favour, and at the same time be much less incommoded by the calms, and light winds, which so commonly prevail farther eastward, but which extend much farther across the Atlantic during the period the sun remains to the northward of the Line than at any other times. Generally speaking, all vessels crossing the Line from the northern into the southern hemisphere, when meeting unexpectedly with variable winds, after losing the N.E. trade, should indifferently prefer that tack, on which they are most likely to attain the objects in view, viz., that of getting to the southward, and of crossing the Line as near as possible between the longitudes of 10° and 15° W. (unless bound to the Brasils or coasts of Guiana), and which, after having passed to the westward of St. Antonio, they may reach with a flowing sheet, and when, as before observed, the S.E. trade will, in all probability, be met with."

2. OF SHIPS BOUND TO AND FROM THE WEST INDIES, WITH INSTRUCTIONS FOR NAVIGATING THEREIN.

THE courses of these ships are regulated by the winds and currents which we have described. The consequence is, a circuitous track, requisite to be taken, not only to the West Indies, but to the southern ports of the United States. For, having passed Cape Finisterre, as before described, the best course is then to the S.S.W., so as to gain the trade-winds quickly. The preceding observations on passing, or touching at, Madeira, &c., may, therefore, in this instance, be useful, as well as in the former.

In a valuable communication which we have received from Captain GEORGE CHEVELEY, of Liverpool, this gentleman incidentally remarks, that he would recommend to ships clearing the English Channel, *if bound for the West Indies*, to make the S.W. quadrant *true*, or so as to pass nearly at an equal distance between Madeira and St. Mary's. Captain Cheveley adds, that, by pursuing this track, he has invariably held a steadier breeze, and got much quicker into the trades, than when he proceeded farther to the eastward, and so endeavoured to make more southing. He is aware that the latter is the *general practice*; of which he entirely disapproves, so far as concerns a West India passage.

SHIPS FOR JAMAICA generally pass to the southward of the Island Montserrat, and thence proceed for the high rock called Alta Vela, off the southern point of St. Domingo, whence they take a departure for the eastern end of Jamaica.* When homeward-bound, they pass either through the Windward Channel or the Strait of Florida, as the wind and other circumstances may prevail or dictate.

Between the months of October and March northerly winds prevail over the Mexican Sea and the adjacent regions; and when northerly winds prevail in the Strait of Florida, the Windward Channel must, of course, be preferred: but, at all other times,—at least, generally at other times,—the quickest and therefore most eligible passage is through the Channel of Yucatan, and thence, with the Florida Stream in your favour, through the Strait of Florida.

Although the Windward Channel appears, by the chart, to be the shorter and readier passage, yet ships are frequently opposed here, both by wind and current; as will appear by the following statement, made by an ingenious officer already quoted:—"After the defeat of the French fleet, commanded by Count de Grasse, in April, 1782, and the British had arrived at Port Royal, in Jamaica, a squadron was detached to gain the Windward Passage, run down the Bahama Old Channel, and cruise to the eastward of the Havanna, to prevent a Spanish squadron, in the harbour, from effecting a junction with the French ships that had escaped into Cape François [*Cape Haytien*]. For six weeks did the English squadron beat against fresh sea-breezes and a lee current; and, during that time, never advanced farther to the eastward than off Morant Harbour, though the ships were much strained by carrying a press of sail to attain the object; but, after struggling so long, were compelled to return, baffled, into port. Now, though the first object might have been to meet the Spanish squadron on its way to Cape François [*Haytien*], if it had

* The Americans, who have been much in the habit of going to the West Indies with timber, &c., remark, that when the flying-fish fly in swarms, and are uncommonly small, it is a certain indication of being near the West India Islands.—*And. Livingston.*

sailed, yet, so soon as the effect of a lee current was ascertained, the object of gaining the Windward Passage ought to have been immediately abandoned, when, by bearing away with a favourable current for some distance, and before a fresh trade-wind, Cape Antonio might have been passed the second day, the squadron have been off the Dry Tortugas on the third, and, by beating along the Florida shore with a weather current, when to the eastward of the meridian of Havanna, it could have stretched over to Cuba in the night; and, in all probability, have gained the appointed station in six days, or even, perhaps, as soon as it could have gained Cape Maize, if the easterly wind had been moderate, and no current to contend with." *

When the trade-wind blows strong, and in frequent squalls, during the summer months, between Jamaica and Hayti, and a short turbulent sea is found eastward of the former, then will those bound for Europe or the United States shorten the period of their voyage by bearing away for the West end of Cuba, and passing through the Strait of Florida. For the strait presents a more eligible navigation in these months than the Windward Channel. The sea-breeze will ensure a quick run to the Channel of Yucatan; and the current, perpetually setting eastward between Cuba and Florida, will, in a few days, carry any vessel into the strait, where it will be nearly impossible to remain much above two days, in the strength of the stream, after being on the parallel of the Bemini Islands, even if there were not a breath of wind.

But as the North winds prevail in the Strait of Florida in October, and frequently during winter, when variable winds and strong land-breezes are not common on the coast of Jamaica, shipping will find this the most favourable period for gaining the Windward Channel. In January or February, if the wind offers a favourable opportunity for gaining the eastern end of Cuba, this track should be taken; but, if the sea-breeze be strong, the Strait of Florida should be preferred.†

When the sun has approached the Tropic of Cancer, strong westerly winds begin to blow along the western coast of Florida, and prevail during the months of June, July,

* "I think that this paragraph, unless qualified, is calculated to mislead; particularly in the words, 'when, by bearing away with a favourable current for some distance, and before a fresh trade-wind, Cape Antonio might have been passed on the second day.' Admitting the general experience of the writer of this passage, I think he states an extreme case. The distance from Port Royal to Cape Antonio is 518 miles; which (divided by 48) equals more than 10¾ miles per hour. Generally, there would be nothing extraordinary in this performance, but I much doubt if it be often accomplished in the locality alluded to, at the time of the year supposed; viz., in the middle of May. Rodney arrived at Port Royal on the 29th of April; it is probable that the squadron was refitted on the 5th of May; allow ten days more for its commander to convince himself of the impossibility of effecting the Windward Passage, and he would have bore up on the 15th; from the inferences I have collected on this head, it appears that the run to Cape Antonio is seldom made in May within a week. In that month of this year [1833] I was ordered from Montego Bay to New Providence: at the former place I consulted some of the most experienced commanders of West Indiamen, whether the most eligible course would be that of Cape Maize or Cape Antonio: the majority recommended the latter, and I more readily deferred to their advice, from its concurrence with that contained in the extract, the previous consideration of which had occupied my mind.

"*May* 18th, at *six p.m.* I sailed; the ship, being light, was in most favourable trim; calms, light winds, and moderate breezes, describe the intervening weather, and we did not pass the cape until the 23rd, at *two p.m.*, or in *four days and twenty hours* after leaving port. This solitary instance, however, would not afford a sufficient basis whereon to fix a rule; in its support, therefore, I cite the *Memoir*, p. 226 [present edition], wherein it appears, that the *Carshalton Park*, in May, 1824 and 1826 respectively, was *seven days* in performing the same distance, although skilfully conducted. Granting the general superiority in the sailing of ships of war over merchantmen, it is not clear to me that a crack West Indiaman, of the present day, coppered and even laden, might not be nearly a match for the comparatively ill-conditioned, and perhaps wood sheathed, squadron, of 1782.

"Finally, although the advice, contained in the extract above, is judicious in establishing the advantages of the Leeward Passage, I repeat, that the hopes of making it so speedily as is represented will not often be realized, for the pages last quoted also show, that neither very favourable currents, nor fresh trade-winds, will be experienced upon that track at the season indicated; nevertheless there is the all-important distinction between the passages of *certainty* and *uncertainty*."—*Lieut. W. H. Brady, R.N.*, late Agent of the *Numa* transport, 1833.

† In sailing for the Windward Channel, get the coast of Hayti on board as soon as you can, as you may then find a windward current, and, in the evening, the wind off-shore.

and August, from the Bay of Apalaché, southward. These westerly winds cause fluctuations in the atmosphere, which prevail more about the western end of Cuba than farther eastward; and near the Havanna they have little influence. At this season vessels from Jamaica have met a westerly wind in the Channel of Yucatan; others have experienced a fair breeze at some distance, after passing Cape Antonio; and the wind here will be found sometimes at N.W., West, and S.W., veering about variably.

The wind in the eastern quarter sometimes fluctuates about the western end of Cuba, but not generally.

At this season the wind blows impetuously off Jamaica, and in frequent squalls; and vessels bound thence to Europe should universally prefer the Leeward Passage. They will probably pass through the Strait of Florida before they could gain the entrance of the Windward Channel, though straining, with every effort, against the wind.* The *appearance* of a favourable opportunity for passing through that channel should not be suffered to deceive; for it may be no indication of the general state of the wind eastward.

Vessels bound from the West Indies to the English Channel, after having cleared the Strait of Florida or Windward Passages, may pass either to the northward or southward of the Bermudas, giving the islands a good offing, and attending to the preceding remarks on currents, &c. (*See page* 204.) In summer, the track to the northward of these isles has been recommended, passing thence to the northward of the Azores. In winter, the track to the southward of the Bermudas is to be preferred; because, in this season, gales of north-westerly wind may be expected from the coasts of America: and, therefore, vessels should continue a little to the southward of lat. 30°, or in about lat. 29° 40′, if wind permits, until certain of being to the eastward of the Bermudas; nor should they run to the northward of lat. 35° or lat. 36°, until within a few degrees of the Azores. Thus will the heavy gales be avoided, which frequently rage more to the northward.†

But upon this subject, Major Rennell has said, "Notwithstanding the advantages to be gained, in point of distance, by ships returning from the West Indies, by the favouring current of the *Gulf Stream*, which may be perhaps reckoned equal to several days' ordinary sailing; yet experienced navigators are still of opinion that, on the whole, it does not present equal advantages with the southern route.

"It was, until latter times, held as a maxim not to advance to the northward of the parallel of lat. 33°, in returning from the West Indies, because of the prevalence of storms to the northward of it. This wise rule of our ancestors has been again taken up, and his Majesty's ships, and of course convoys, will be, in future, directed to proceed by the South of Bermudas, and to cross its parallel at a few degrees to the eastward of the isles, and thence to steer direct for Corvo.

"But, it may be observed, that a track which should cross the parallel of Bermudas at a *very few* degrees to the eastward of it, and then lead directly toward Corvo, would cross a most critical portion of the space, in which not only the warm water of the Gulf Stream prevailed, but in which several gales have been actually experienced. Therefore, it would seem that the parallel of the Bermudas should not be crossed at less than about lat. 15° [say lat. 14°] to the eastward of the islands.

"But, it may be asked, Where is the necessity of going to Corvo or Flores at all, for by it ships are placed in a situation proverbially known as a place of storms; that is to say, on the West and N.W. of the Azores? Why not go between *them* and the *greater Azores;* or rather to the southward of them all, and thereby pass through a kindlier climate at all times?

"Any calculation or comparisons of time in making the different passages would be nugatory; since the security of lives and property is the main object; but it even happens that ships, which have had all the advantage of the Gulf Stream, have been crippled, and made more delay than in the southern passage with adverse currents."

* See Observations on Winds, page 128.

† As the most destructive hurricanes on record, in this part of the Atlantic, have occurred in the vicinity or on the borders of the Gulf Stream, this is an important reason for ships from the West Indies, bound to Europe, not to advance too far to the northward. See, farther, *Voyage from the West Indies to the Azores,* attached to the description of those islands hereafter.

On the 17th of July, 1828, H.M.S. *Bustard* sailed from New Providence for England; winds from the southward, and rainy weather. *Found a current setting to the eastward, at an average of nearly three-quarters of a mile per hour, to lon.* 60°. Having passed to the southward of Bermudas, off the Western Islands had thick hazy weather, with small rain. Winds very variable. On the 11th of August ran into Fayal Roads from the northward, and anchored in 20 fathoms, with the West end of St. George's Island E. by N. ½ N., Castle of Sta. Cruz, situated near the South part of the town of Orta, W.N.W., off-shore about a mile. Supplies may be obtained here at a cheap rate, but the water is rather brackish. Found the longitude of the anchorage, by chronometer, 28° 41′ 30″. The current runs strongly here, and between Pico and Fayal it seemed to set at the rate of nearly 3 miles in an hour.

Directions for Sailing to and from the West Indies and North America: translated from the "Derrotero de las Antillas," by Captain Livingston.

These advices, or directions, are simple applications of a principle derived from the general prevalence of the winds, as already described.

Were it not for the constant wind from the eastward, which reigns within the tropics, it seems likely that the maritime commerce, between the two hemispheres, would never have existed; for, by its means, not only are the voyages rendered very simple, which would otherwise be interminable, but people in the most distant regions communicate with facility: and thus the navigator who is bound to the westward has only to place himself within the limits of the general wind, in the certainty that, in this manner, he must effect his purpose in the shortest possible period. Such is the *first* rule, which ought always to be attended to for this navigation.

The *second rule* is derived from the first; it is, that any one, bound to the East from the West, ought to get out of the region of the General Winds into that of the Variables.

We have here the two precepts which direct the operation of navigators in extensive seas; and, in attending to them, we shall observe, that every one bound from the Peninsula (Spain and Portugal) to the eastern coasts of America ought to get into the trade-winds as soon as may be, holding in mind an advice, which may be considered as a precept, that is, *never, in navigating extensive seas, to keep close-hauled, but always take care to sail with the wind free; or at least to keep seven points from it.*

Taking it as granted that the first care of every one bound to America ought to be to get into the limits of the general wind, it is clear that, with scant winds, the tack in the third quadrant (S.W.) will be most advantageous, and ought to be followed always when it can. All the endeavour ought to be to get into these winds, without being particular as to the means, and without keeping close to the wind to pass between the coast of Africa and the Canaries; but taking the passage that suits best, be it that between the Canaries and Madeira, or be it between Madeira and the Azores: and certainly either of these is preferable to that to the East of the Canaries; for the proximity of the coast of Africa deadens the wind, and, consequently, is unfavourable to the brevity of the navigation.

Having gained the general winds, the navigator must take precautions conducing to prevent any error of situation, in making his port of destination; for, if he who navigates by observations is exposed to be even 10 leagues in error, he who has no more than dead-reckoning to direct him may, probably, be six degrees wrong. It imports much to guard against this error; keeping it in view that, in proportion as it will be easy for any one, making a landfall to windward of his port of destination, to run down to it; so will be the difficulty if he makes the landfall to leeward of his port, in beating up again in a sea wherein both the winds and currents are contrary. Even if bound to the coasts of the United States of America, it will be advisable to run into the limits of the trade-winds, in order to get to the westward in as short a time as possible; and although this mode may appear long, on account of having again, after crossing, to augment the latitude, it will be sufficient to keep in view the following maxim, to convince any one of the contrary:—*If in the one way the distance is shorter, in the other the velocity with which the ship proceeds toward her port of destination more than balances it.*

There are, nevertheless, many occasions on which a vessel may run across to the

American coast without reducing her latitude, and these occasions may be frequent in the forty or fifty days which follow the two equinoxes, as epochs during which the N.E. winds generally prevail; therefore vessels which, at these times, make their passages, may at once follow their voyage in high parallels, without descending to low ones.

In summer, as the region of the general or trade-winds extends to about lat. 28° 30′ N., it follows that the round about is trifling; and this circumstance ought to be attended to in the calculations which every captain of a ship ought to make before he fixes on the course he will pursue.

Recapitulating what we have said about the course which is most advisable for crossing to the United States, from the coasts of the Peninsula, it follows that, if the winds permit it, West is the preferable course; and, in case the winds will not allow of shaping that course, the most advisable track will be that which comes nearest to it, if the voyage is made at the times above mentioned after the equinoxes; but if at any other time, a course in the third quadrant [S.W.] should be preferred; for this will carry the vessel soonest into the general winds, with which the necessary longitude may be shortly gained.

VESSELS BOUND TO CUBA during the rainy season, or season of the South winds, should pass to the northward of Porto Rico and Hayti: but, during the Norths, they ought to go to the southward of these islands. The ports chiefly frequented are, St. Iago on the South, and Havanna on the N.W. If bound to the first, it is necessary, in whatever season, to proceed directly to it: that is, in the season of the Norths, to steer from Cape Tiburon, to make some point on the South of Cuba to windward of the intended port, or even to windward of Guantanamo; and, in the season of the Souths, to steer from the Point of Mole St. Nicholas, almost West for the port, marking, in the first instance, various points on the coast of Cuba.

If bound to Havanna, in the time of the Norths, you should pass to the southward of Cuba, although you will have to return the distance, between Cape Antonio and Havanna; because this inconvenience is not comparable to that which might be occasioned on the North side of the island by a hard *North*, which would not only expose a vessel to heavy risks, but might protract the voyage much longer than the course above described, because the distance in the latter case may be worked up in a short time.

From St. Iago de Cuba, as the coast is clear, a vessel for Europe may easily make her way by the Windward Passages, while all those which are bound from Havanna will take the Strait of Florida. The risks in the latter emanated from bad charts and ignorance of the currents: the charts are now rectified, and the current is known.

By the STRAIT of FLORIDA we understand the space included between the meridian of the Dry Tortugas and the parallel of Cape Canaveral. The simple inspection of the chart will show this to be a bed or course, which, like a river, conducts the water to the northward. This river, or general current, flows first to the E.N.E. as far as the western meridian of the Double Shot Kays, by which Kays the stream is divided from E.N.E. to N. by E., the direction which it pursues on the parallel of Cape Florida: thence to Cape Canaveral it runs North, with something of an inclination to the East.

As it is undoubted that this general current is caused by a superabundance of waters, which seek, by this drain, to regain their level in the open ocean, it follows that its rapidity will be greater or less, according to the said superabundance of waters: but, as a change cannot be momentary, on account of the great reservoir in which the water is contained, but progressive, and, of course, slow; we hold that, having once ascertained the velocity of the current, we may calculate it for three days or more, in advance, without much error, if the wind remains in the same direction; for an alteration in the wind may affect the force of the current considerably, as already explained.

On the meridian of the Havanna stripes of current are, at times, found setting to the E.S.E. and S.E. from the Tortugas Soundings. Care should be taken not to confuse the southern differences, caused by this branch of the current, with those caused by the eddy current near the Colorados; the one giving eastern departure, the other West. The distinction is very clear, and can admit of no doubt, because the eddy current is met only from the meridians of Cavanas and Bahia Honda to Cape Antonio, and not farther out from the coast than the parallel of 93°.

As the velocity of the current varies, it is requisite for every navigator to ascertain its strength as frequently as possible, while within the stream. Every one who enters this channel, having marked well either the lands of Cuba or the Florida Reef, so as accu-

rately to establish this point of departure, ought to determine, in his *first day's* work, the velocity of the current by the difference of latitude by account and observation. We say, during the first day's work, because the generality of common navigators make use of meridian altitudes of the sun alone to find the latitude; but it is very clear that *altitudes of the planets and fixed stars ought not to be neglected; not only because by this you cannot be in doubt of your real latitude, but also, because they may be more exact than latitudes deduced from meridional altitudes of the sun, when that luminary passes in the proximity of the zenith, and because these repeated observations, during the night, assure, as much as possible, the situation of the ship.* Thus you may go on, with a clear idea of the operation of the current, and the way that the ship is making. Having ascertained the velocity of the current, use can be made of it to find the ship's departure, and this knowledge will be most important when you fail in obtaining observations for latitude; because, in such a case, wanting a knowledge of the difference of latitude given by the current, you will be in want of everything; but, if you know the velocity of the current, with it and the course which it follows, you may find the difference of latitude and departure which the current gives; and which, though it will not give the position of the ship with that precision with which it might be obtained by latitude observed, will still approximate sufficiently to the truth to enable one to avoid danger, if prudence and seaman-like conduct are combined.

For those who have little experience in the art of navigation, we add—

1.—That it is most convenient to direct your course in mid-channel; not only because it is the farthest from danger, but because you will there have the strongest current, which is desirable.

2.—That, as you cannot ascertain, with all necessary certainty, the position of the ship, notwithstanding the rules given to diminish the errors occasioned by the currents, you ought, with the utmost care, to shun the eastern coast of Florida, as being very dangerous, the trade-wind blowing upon it; while there is not the least risk in running along the Salt Kay Bank, and the edge of the Great Bank of Bahama. Upon the latter, also, you meet with good anchorages, very fit to lie in during the hard northerly gales experienced between November and March, and which do not fail to cause many damages, and sometimes even force vessels to bear away, which is always dangerous, for the weather is always thick with such winds, and the worst case will be to run in one of them upon the coast of Cuba, when hoping to have made Havanna or Matanzas. Hence, therefore, so soon as there is an appearance of a North, the best way is, if near the Salt Kay Bank, to anchor on it; and, if near the Great Bank, to approach the edge of it, in order to be able to anchor when it may be necessary; for, although you may have a hard *North*, so long as you can lie-to in it, you ought to pursue your navigation, as the current will certainly carry the ship through the strait.

3.—It is very necessary to sight the Kays on the Salt Kay Bank, even though you have no fear of a *North;* and there may be occasions in which every exertion should be made to make them; especially if, from want of observations, the situation of the ship is not well known.

4.—When, owing to calms or light winds, a vessel is in danger of being carried through the strait by the current, she ought immediately to approach the edge of the Salt Kay Bank, or of the Great Bank, to descend from it to the coast of Cuba, without trying to beat down the lost ground; for, by doing this, she would only render the being carried through more certain.

5.—Should you involuntarily approach the coast of Florida, you should take extraordinary care to examine whether you have advanced out of the general current and into the eddy. That you may know this, observe, the eddy forms a remarkable and visible line between it and the general current, which line of division is, in many places, out of sight of land; that, in general, you have no soundings on it; and that it shows, not only by the change in the colour of the water, but that also in it, during the greatest calms, there is a kind of boiling or overfalling of the water. From this line of division the water gradually changes colour; so that, near the Florida Kays, it is of a beautiful sea-green, and at last it becomes almost as white as milk.

6.—When in the eddy you have to make the correction of currents on courses entirely different from those in the stream. This is the more necessary to be remarked, because, from ignorance of this circumstance, several have been shipwrecked.

7.—When you enter the channel, or strait, from the Tortugas Soundings, with the intention of passing through, take care to become certain of the land of Cuba, or some part of the Reef of Florida, in order to have a good point of departure; for, although the latitudes and soundings on the Tortugas Bank are more than sufficient to ascertain the place of the ship, yet the variable set of the current toward the Havanna may produce a serious error, if not properly attended to. The meridian of the Havanna is, in a word, the best point of departure for ships bound to the north-eastward.

ON PROCEEDING TO THE WINDWARD OR CARIBBEE ISLANDS.

As to choosing the North or South part of any of these isles for making your landfall, you ought to consider, *first*, which point is nearest to the port or road to which you are destined; and, *secondly*, the season in which you go. In the dry season, it is to be remembered that the winds are generally from the north-eastward, and in the rainy season they are often from the south-eastward. Thus, in the dry season, it is best to make the North side, and, in the wet season, the South, but without losing sight of the first consideration.

There can be no mistake in recognising any of the Antillas; nor, in making ST. BARTHOLOMEW'S and ST. MARTIN'S alone, can there be any doubt on seeing at once the eminences or heights of various islands. That this may not mislead any one, they must remember the following instructions:—

When in the parallel of St. Bartholomew's, at less than 4 leagues off, if there be no fog or haze, the Islands of St. Eustatius, Saba, St. Christopher's, Nevis, and St. Martin's, appear plainly.

The mountain of ST. EUSTATIUS forms a kind of table, with uniform declivities to the East and West: the top is level; and at the East part of this plain a peak rises, which makes it very remarkable. To the West of the mountain seems to be a great strait, in consequence of the lands near it being under the horizon (or seeming drowned), and to the West of that there then appears, as it were, another long low island, the N.W. part of which is highest; but it is necessary not to be deceived, for all that land is part of the land of St. Eustatius. From this station Saba appears to the N.W.; it is not so high as St. Eustatius, and apparently of less extent than the western part of St. Eustatius, which is seen insulated.

The *N.W. part of* ST. CHRISTOPHER'S is also seen formed by great mountains, in appearance as elevated as St. Eustatius, with low land to the East; to the eastward of this low land NEVIS will be seen apparently higher than all the others.

The lands of ST. MARTIN'S are notably higher than those of St. Bartholomew's; and this island appears also when you are some leagues farther from it than from St. Bartholomew's.

When there are any clouds which hinder St. Martin's from being seen, there may be some hesitation in recognising ST. BARTHOLOMEW'S; and thus it is proper to notice that the latter, seen upon its own parallel, appears small, and with four peaks, trending North and South, and occupying almost its whole extent; and, if you are not more than 8 leagues from it, you will see, also, the appearance of an islet to the North, and another to the South, at a very short distance. As this island has neither trees, high mountains, nor thickets, it is not subject to fogs; and it may therefore be seen oftener than St. Martin's, St. Christopher's, Nevis, St. Eustatius, and Saba; it is therefore advisable to keep its appearance in mind.

At 8 leagues to the East of St. Bartholomew's you may see NEVIS, very high; from it to the West the strait called the Narrows, and then the lands of ST. CHRISTOPHER'S, appearing to rise out of the water, and which continue increasing in height to the westward, so that the westernmost of two mountains, which are at the West part of it, is the highest. This mountain, which is higher than that called *Mount Misery*, has, to the West of it, a gentle declivity, terminating in low land; and it cannot be mistaken for any other. To the West of this you may also see the large strait toward ST. EUSTATIUS; but from this situation you will see only the high S.E. part of that island; or rather, its mountain, in consequence of which it appears like a very small island, while its mountain seems to be lower than Mount Misery; but it is easily known by the *table*, which its

top forms, by the uniform declivities to the East and West, and by the peak on the S.E. part of it. SABA seems, from this situation, equal in size to the visible part of St. Eustatius; but it shows only an eminence without peaks, with uniform declivities, and almost round.

If a small islet appears to the West of, and very near to, St. Eustatius, that must not confuse you; for it is the N.W. extremity of that island; and, on getting nearer, you will perceive the land which connects it with the S.E. part. *Mount Misery*, on St. Christopher's, which has a very high and sharp peak, on the eastern part of its summit, seems at a distance to be the summit of Mount Eustatius; but it cannot be mistaken for such, if you attend to its surface being more unequal than the table land at the top of St. Eustatius; and that there is another less elevated mountain to the East, and with gentle declivities, which show much land to the East and West of the high peak.

When you are 6 leagues to the East of St. Bartholomew's, its N.W. extremity appears insulated, and has the appearance of a pretty large island, on the top of which there are four small steps (like steps of stairs, *Escalones*), with a considerable strait to the South, between it and the principal island: in the middle of this strait you may also see a smaller islet: this is really one of the islets which surround the island; but the first is only the N.W. point, to the North of which you will also see some islets: all these are much nearer St. Bartholomew's than St. Martin's.

FINALLY, in navigating from one of the Antillas to another, there is no difficulty, unless you have to get from leeward to windward; yet this will be reduced to a trifling consideration if the passage be made by the straits to the northward of Martinique, and in which the currents are weakest; but the same does not follow in the southerly straits, in which the waters set with more vivacity toward the West: and it would be impracticable by the Straits of Tobago, Granada, and St. Vincent, in which the waters commonly run at the rate of not less than 2 miles an hour.

PARTICULAR INSTRUCTIONS FOR THE NAVIGATION OF THE WINDWARD ISLANDS, &c.

It has been lately remarked, by an experienced captain in the Royal Navy, that for *those bound to Jamaica or to any of the ports in the northern range of islands* (the Bahamas excepted), the safest land to make is the Island of Desirade, near Guadaloupe; for, if you should not see other land before dark, you may haul to the northward, into the latitude of Montserrat, having nearly 60 miles to run on, during the night. Some commanders make St. Martin's or St. Bartholomew's, when bound to Tortola, St. Thomas's, St. Croix, and the islands to leeward; but in this case they should be aware of the dangerous Island of Barbuda, and also of Anguilla; for a small error in the latitude, perhaps, from want of an observation, or irregularity in the current, would place them in a very perilous situation, should they attempt to run on in the night.

Strangers should pass St. Martin's, when they make it, on the North side, the passage between it and Anguilla being clear; St. Bartholomew's, Nevis, St. Christopher's, and Antigua, on the South side. Barbadoes should likewise be passed on the South side, in order to fetch into Carlisle Bay; and Granada and St. Vincent's on the South side. No particular directions are necessary for the other islands, as every seaman knows the danger of running to leeward or past the land;—a very serious occurrence for a dull sailing-vessel.

Vessels on making Barbadoes and the other Windward Islands, when approaching from the northward, should be very careful not to cross the latitude of the low or northern islands during the night, although their reckoning may be many degrees to the eastward of the isles. The low islands on which so many vessels have been lost, are *Barbuda*, *Anguilla*, *Dog and Prickly Pear*, *Sombrero*, *Anegada*, and its *Horse-shoe Reef;* of all these, the first and last are the most dangerous. Before you see Anegada, in clear weather, Virgin-Gorda, and perhaps Tortola, will be seen very distinctly; distance is often deceiving at sea, and this land, by those not well acquainted with it, has been frequently mistaken for the East end of Porto Rico; and, although directions have been given for avoiding this error, by observing that there is only open sea to the eastward of Virgin-Gorda, and that to the eastward of Porto Rico lie several islands, yet it is necessary to observe that these islands, when the high land of Porto Rico is first discovered, cannot

be seen, so that, if you make the land at the close of day, it is proper to be aware of this circumstance. It may be also remarked, that Anguilla and the Dog and Prickly Pear Isles cannot be seen until some time after you make St. Martin's, which is high land, and lying to the southward of these low isles. Barbuda is not dangerous in the night-time only, but to strangers also in the day, having reefs under water all round, excepting at the extreme S.W. point.

On passing to leeward of the high islands which obstruct the course of the trade-wind, danger arises from strong gusts coming from the mountains, which sometimes dismast a vessel. Be cautious to keep so far from such land as to be able to work your ship, should the wind suddenly shift and blow on the shore, which it often does during the day. When the wind is baffling, you will find it advantageous to keep your course along shore so long as you have steerage-way, although all your sails may be aback; for it frequently happens that the wind comes round to its former quarter before you lose your headway, and by this one ship may get into another current of air, which brought her into a fresh breeze, while another, in company, by altering her course to get her sails full, loses the opportunity of getting into the breeze, and may be detained by calms and baffling winds great part of the day. We have often seen the after-sails filled, with the wind aft, while the headsails were flat aback, with the wind ahead, and which continued so long that the foresail was hauled up to continue the headway.

In navigating among the Windward Islands, every precaution must be taken in allowing for the direction and strength of the currents. It has already been shown, in the preceding section, that the general prevalence of them is to the westward, but with different velocities, disturbed at times by the lunar influence, and varied by the contour of the coast, &c. An easterly current is seldom or never found out of sight of land, but N.W. and northerly, in the passages, may generally be found; and it has been remarked that, in some instances, when the current runs to leeward on one side it runs to windward on the other; also that it may set to windward on both sides, while, at the same time, to leeward in the middle, and frequently the reverse.

The intelligent officer to whose book we are indebted for these observations, says, "In the daytime, attention to the progress you make in getting to windward, by the appearance or bearings of the land, is the best rule you can have, first trying a short tack in-shore, where, if you make little or no progress to windward, your best way is to stand across, and try the other side of the channel; and, if that do not answer, the mid-channel will most likely prove the best; for, although contrary to the general opinion, we have often found it so; much, however, depends on the time of day. In the morning and evening you should endeavour to be near the shore, the North side of the passage in preference, where, if the wind be moderate, and the coast not much exposed to the general trade-wind, you are pretty certain of having the wind two or three points more off the land. In like manner, you should endeavour to be in the offing about one o'clock p.m., as the wind generally blows more on the shore at that time. We have also observed that the land and sea breezes prevail most where the land on the coast is low.

"*Should you be bound to a place to the eastward of you*, and no land in the way, the best tack to be upon is the one on which you will lie up nearest to E. by N., that being the point from which the trade-wind generally blows; when it changes from that point you may consider it a slant of wind, and take advantage of it accordingly,—particularly if it veer to the South during the day, or to the North by night; thus it will be found to be advantageous to be on the larboard tack at night, and the starboard tack by day."

In squally weather the wind is so very variable, that it is seldom possible to take advantage of it in getting to windward.

To windward of the islands and to the North of Barbadoes, in moderate trade-winds, the Equatorial current will be found generally to set in a direction from N.W. by N. to N. by W. at the rate of from half a mile to three-quarters of a mile an hour. As you approach the islands, it becomes more irregular; near to the eastward of *Point Salines*, Martinique, it frequently sets strong to the North, and even N.E. We have also felt this set of the current near to Point Moulacique, the South point of St. Lucia, and have frequently seen vessels bound to Gros Islet Bay, St. Lucia, from Barbadoes only the night before, driven so far to the North as to have passed the Island of St. Lucia, and also a considerable part of Martinique, before they discovered their mistake; and, being strangers, they had to wait until an observation could be taken to ascertain the latitude, before they could find out their true situation.

In the passages lying nearly in a North and South direction the current sets generally about N.N.W., until you are past the most northerly land on the eastern side of the passage, when the western current, being no longer obstructed by the land, sets with great strength in a more westerly direction. This is the case in all the passages from Antigua to Hayti, and those on the South between Trinidad and Paria, and on the coast and Leeward Islands from Margarita to Buen-ayre, as the current inside to the South of these islands [in the dry season] sets about N.N.W. ½ W., at the rate of nearly 2 miles an hour. Ships running to westward, inside, should make an allowance for it, and keep a good look out, for it must be borne in mind, as already shown, that the currents here are variable, according to the season.

In order to touch at as many of the Windward Islands as possible, without having to beat to windward;—suppose your vessel to be at Barbadoes, and you have to call at as many islands as you can, in as little time as possible—from Barbadoes you can steer for Tobago, hence for St. Vincent's, which is as far to windward as you can fetch; and, with a northerly trade-wind, you will not be able to do that. From St. Vincent's you may steer to any of the Granadines, and so on to Granada; and, at times, you may fetch Trinidad, but this is not to be depended on. From Granada you cannot always fetch St. Kitt's, but in general, the Virgin Islands, St. Croix, St. Thomas's, &c. The general course this way is to go to Tobago, and thence to Trinidad.

Another track is from Barbadoes (S.W. side) to St. Vincent (South side), hence to the Granadines and Granada.

From Barbadoes to the N.W. you may go to St. Lucia, passing round the N.E. point of the island to Gros Islet Bay and the Careenage; from this place you fetch Fort Royal Bay, Martinique, then St. Pierre, Roseau (Dominica), the Saintes, Basse-terre, and sometimes Point-a-Pitre, Guadaloupe.

From Basse-terre, Guadaloupe, you can seldom weather Montserrat, unless you tack and take advantage of the variable winds under Guadaloupe, which is the best way, if you are bound to Antigua, or to the northward between Antigua and Nevis; but if not, you may pass close to the West side of Montserrat, and so steer for Nevis or St. Kitt's, or to the islands to the westward; or, you may pass on either side of St. Eustatius or Saba, if you can lie round without tacking, and so through the Dog and Prickly Pear or Sombrero passage to the northward.

In steering through these passages, or across them, it is recommended to keep well to windward, as the wind will often head you as you approach the opposite side, and the currents are very strong; and, it may be remarked that, in standing to the southward, you feel the force of the current more than when you are standing to the northward.

From these remarks, and a reference to the chart of the islands, it may be readily seen what other track can be accomplished. Thus, from Barbadoes to Antigua, and the islands to the westward of it, you pass to the eastward of Desirade if you can; if not, between that island and the East point of Guadaloupe; when you are clear of this last point, you have Antigua and all the islands to the westward in your route.

The intercourse between Barbadoes and Demerary is very uncertain, and you cannot always trust to fetch from one place to the other, even in fast-sailing vessels. From Demerary you can generally weather Tobago; of course it must always depend on the wind and current; therefore we speak in general terms only. Indeed, we have sometimes seen southerly trade-winds continue for a long time, and also northerly winds; and we have seen, owing to N.E. winds and lee-currents, vessels from Cayenne not able to weather Barbadoes, and a vessel from Antigua a month in getting to Barbadoes, owing to southerly winds.

In working to windward through any of the passages in the night-time, it is strongly recommended not to trust to the distance run; for, although you may have an offing of 4 leagues, and you could lie up so as to make a long stretch, yet, before you have gone the distance of your offing, you will probably find it full time to tack from the shore. *In the passages lying nearly East and West*, the western current runs so swiftly, that, in standing to the southward on the larboard tack, and lying up S.E. by E., you will often find that you have made little or no easting. This has been the case with several vessels leaving the South shore of Antigua; they stood on, lying up S.E. by E., which course they expected to make good, and thought perhaps to weather Point Antigua on Guadaloupe, but the current deceived them, little or no easting had been made, and they run ashore among the small kays off the Bay Mahaut, Guada-

loupe, nearly due South from that part of Antigua which they had left in the previous evening.

When bound to windward it is sometimes difficult to beat through the passages between the islands. Of these passages, the easiest are considered to be between St. Vincent's and Becquia, between Martinique and St. Lucia, and between Antigua and Guadaloupe. The wind, in general, blows a strong breeze, so that a vessel may carry double-reefed topsails, courses, top-gallant sails, jib, and driver. These are the most suitable sails for working the ship in the night, the weather in the passages being too generally squally. If more reefs are out, you will be liable to spring your masts and yards; for however fine the weather may appear, strong and sudden gusts may come on several times in an hour. Finally, too much sail is hazardous, as the squalls may head you until they blow past, when you come up to your old point; and in this way it is obvious you may run a long way to leeward in carrying sail through a squall.

Throughout the West-Indian Sea, among the islands, the bottom will be generally found to consist of coral rocks, and the great advantage of having chain cables, both in point of safety and economy, must be obvious to all.—"*The Seaman's Practical Guide*," &c., 1832.

General Remarks on the Navigation of the Caribbean Sea, from Leeward to Windward, by Lieut. Greevelink.

The best way to beat up in the Caribbean Sea is still an object of dispute among a great many European mariners; there are some, and they form the greatest number, who always prefer the northern part; others who choose to keep in the middle between 14° and 16° of latitude; and a few, to beat up off the southern coast, till they are able to make Antigua, and run out by the channel between that island and Guadaloupe.

The first of these methods, the one generally adopted, is evidently the best: as the South coasts of Hayti and Porto-Rico are tolerably clean, and afford smooth water when the wind is to the northward of East; but in the hurricane months, this part is rendered unfavourable, not only by these dangerous visitors, but also because the currents are then often very strong in the northern channels, whereas they have, at the same time, been observed to be very weak in those southward.

The second route depends, I imagine, more on vague reports of a current setting between those parallels to the eastward; but this will, I trust, no longer be credited, at least, in the tract of sea here described. During the intervals, however, in which light winds are of some duration, the westerly current may be found very weak, as is undoubtedly proved by our passage in April, 1837. (See the entry of that month, Col. Nav., vol. iii. p. 26.) Yet this is no reason why a constant weak current, or an easterly one, should be stated when found only occasionally in those parts where they have once been met with.

The third route, by which the hurricanes are generally avoided, has been treated with too much neglect, partly by its being impeded by the Leeward Islands, and partly by the unknown force and direction of currents, and want of local experience of the coast; but hereafter I doubt not but this track will be adopted as the best in those months which threaten destruction in the northern passages, because it is almost universally followed by the coasters and pilots.

Commanders bound from one of the interior parts of the Caribbean Sea, toward the coast of Guyana, generally prefer passing out by the channel of Antigua and Guadaloupe, which is one of the fittest for that purpose with northerly winds; but when, on the contrary, the wind is from the southward of East, I should not advise any attempt to pass that way, but to proceed directly to the North, by the westward of Barbuda, prolonging the stretch well, in order to gain at once, with the other tack, the windward side of the islands. In July, 1836, we laboured for several days to get out of the first-mentioned passage; and in August, 1835, we were happy enough to reach English harbour, though unable to effect our purpose of getting into the main sea, being harassed by south-easterly winds and strong westerly currents; and during our stay were visited by the hurricane which has been described.—(See page 131.)

After having reached the Atlantic, when destined toward the coast of Guyana, it is best

to keep your wind, if blowing from the northward of East; as, in that case, it may enable you in one stretch to make the desired port; but, with unfavourable winds, I think it advisable to run straight for the coast, and beat to windward therealong in the space of soundings. This is most probably attended with less loss of time than the working to the eastward in higher latitude, which may be proved beyond any doubt by comparing some of the many instances which have occurred of vessels falling to leeward of their port of destination, and which tried to regain it by making a long stretch to the northward: when, after fourteen days, they made the coast nearly at the same place; with those of others who effected it completely, in only three or four days, in the space mentioned. I know many reports of this sort, but they want sufficient authenticity to be relied on.

As a general remark, it may be kept in mind that to get soundings ought to be the principal object of ships bound to this coast, as, with the present knowledge of depths hereabout, together with an observed latitude, it may show them their place of situation East or West of the intended place very near the truth, because the general tendency of the mud-bank is nearly N.W. and S.E.; and thus, to the eastward of a certain meridian, there will be found more water than to the westward, upon the same parallel.

It is absolutely erroneous to state, that the extent of soundings is marked by the change in the colour of the water; as more than once, and particularly in November, 1834, in 25 fathoms of water, to the N.E. off Marowyne river, the colour was perfectly blue and transparent, and at otlier times tinged of an ashy hue by the mud.

Bermudas to the Windward Islands, &c.

Mr. Henry Davy, in his description of the passage of H.M.S. *Cornwallis*, between the Bermudas and the West India Islands, with the return toward Halifax, in the winter of 1837, states as follows:—

From Bermuda to Barbadoes, instead of steering direct, I would recommend a S.E. by S. course. The advantage of this will be apparent, should the trade-wind be to the southward of East, and it is also a precaution against a leewardly current.

We left Bermuda on the 26th of November, 1837; and, pursuing the above course, until fairly in the trade, anchored at Barbadoes on the 6th of December. Made the North end of the island at four a.m. at daylight, appearing in a long and very low point. While on the starboard bow Kitridge Point* made equally so, with extensive breakers far out. We rounded the island at a distance of 2 miles, the coast presenting successive low points, encompassed with breakers, and came to anchor in *Carlisle Bay.*

The *Cornwallis* next passed the Granadines, and the lofty summit of Granada became visible at noon of December 10th, as the heavy clouds rolled away to the westward. The ship then proceeded to the anchorage on the S.W. side of Granada. Here, in 15 fathoms, a tide set past the ship to the S.S.W. at the rate of 2 miles in the hour; at midnight the ship tended, and the tide set through to the eastward, at the same rate. At eight a.m. of the following day it again made to the S.S.W., and by ten its rate was 3 miles. This tide renders the spot valuable as a temporary anchorage.

From the information of the harbour-master it appears that, at the springs, the tide here obtains a rate of 4 to 5 knots; that it is strong among the Granadines, at St. Vincent's, and to the southward of Granada toward Trinidad. He was also of opinion that throughout the range of the Caribbean Islands the tides were of more consequence than as hitherto considered; and it appears probable that many of the accounts which reach us, respecting the *currents in opposite directions*, often in the same places, may be the effect of *tides.*

At sunset of the 11th of December, the *Cornwallis*, full of troops, set sail for Halifax. Mr. Davy says, "A fine moonlight evening followed; the ship gliding along the western coast, as we shaped a course for St. Kitt's, which I should always recommend to vessels intending to take the Anegada Channel. At sunset, Montserrat, Redonda, Nevis, St. Christopher's, St. Eustatius, and Saba, were in sight. At ten we passed between St. Eustatius and Saba, closing Saba to within 2 miles. When its North point bore West,

* Kitridge Point is the S.E. point of the island.

3 miles, steered N.N.W. for Dog Island and Hat Hay. At half-past three in the middle watch, we made the Dog Islands. At six a.m. Sombrero bore E N.E., and at eight we were fairly clear of the West Indies, and steering away N.W. for Halifax, with the trade-wind at E.N.E. No variation. Thermometer 80°; temperature of the surface water, 78°. From this to the parallel of Bermuda the temperature of the water changed from 78° to 68°. Here, in 33° North latitude, we exchanged the flying fish for the stormy petrel.

The north-westerly winds have a great ascendency at this period, and prevail over every other quarter. I would, therefore, advise making the most of the trade, and steering away N.N.W., continuing to make as much westing as will ensure fetching Halifax with the prevailing wind.—*Nautical Magazine*, July, 1838.

Passages between Jamaica and Yucatan, Chagre, Cartagena, Maracaybo, &c.

To the Bay of Honduras; by the late Mr. Johnson Capes, a constant Trader.

Take your departure from the West end of Jamaica, and steer W.S.W. by compass, until you get into lat. 16° 35′; then run on that parallel till you make the Island of Bonacca, the latitude of which is 16° 30′, lon. 85° 47′ West. (The northern and easternmost part of the island is here meant.) Bonacca is a bold high island, and may be made by night, if required; as I do not know of any danger that extends more than 1 or 2 miles off on the North side. Some navigators endeavour to make Swan Islands, but that cannot be of any advantage to them, and is the contrary; for, if you expect to be near them in the night, you get very anxious, as they are very low, and you may run on them before you perceive your danger. I always give them a good berth, that is, keep to the southward; for the current about these islands is very deceiving and uncertain: but, for the most part, sets to the northward and westward. In one of my voyages to the bay, I was set 34 miles to the northward, and 64 miles to the westward, of *account*.

Bonacca ought to be made early in the day, so that you may run down to the middle or West end of Ruatan by the evening, to be ready to take your departure for the Southern Four Kays, at six, seven, or eight o'clock, according to the breeze you have.

If you take your departure from the middle of Ruatan, steer W.N.W. ¼ W., making that course good, in order to avoid Glover's Reef to leeward, and on no account whatever run more than 45 miles from Ruatan before daylight; if you run more than that distance, you are in danger of running your vessel on the reef, where there is no possibility of saving her, for in a short time she will be a perfect wreck. At daylight make all sail possible, and if you do not see the kays you will soon lift them. The principal kay is called Half-Moon Kay, owing to its having a sandy bay, in the shape of a half-moon; on this kay is the Lighthouse, elevated about 50 feet from the surface of the sea; its latitude is 17° 12′ North, and longitude 87° 32′ West. [*See Note* 15, *page* 114.] On this kay the pilots live; a set of useful, active, steady, sober men. These kays ought to be made as early in the day as possible, in order to ensure you an anchorage before night.

It frequently happens that vessels, after leaving Ruatan, are becalmed during the night; and, in consequence, they will not make Half-Moon Kay before the afternoon. In this case, I would advise the master to brace sharp up, on a wind, and beat to windward all night, tacking every two hours; for, it is to be particularly noticed that the current sets strongly down on the Southern Four Kays Reef. Several vessels have been lost on this reef, owing to their lying-to; but by keeping the light in sight till morning, it will be sufficient to prevent accident by maintaining your position till you get a pilot, or till you have the day before you.

If it should happen that the pilots are all in Balize (which is very seldom the case), you must make all sail possible. Keep a man at the mast-head, and you will soon discern a kay, called *Hat Kay;* it is about the size of a long-boat, with trees upon it. You may round the reef, within 2 or 3 cables' length, as there is no danger but what you may see, for soundings extend but a short distance from the blue water. After you have rounded the elbow of the reef, steer West, and you will very soon lift the low land of Turneff: at the South end of this marsh is a little kay, called, by the pilots, *Kay-Bokel*, with several cocoa-nut trees upon it. (Formerly pilots resided on this kay, and now

frequently rendezvous here.) You may round this kay by your lead; and, if it be later than three p.m., you must anchor here for the night.

The anchorage is about 1¼ miles from the kay, with it bearing E. by S.; but your lead and your eye is the best pilot for this anchorage. You anchor on a fine white sand-bank; the first soundings you will get is about 10 fathoms; run into 3 or 4 fathoms, clueing your sails up as fast as possible, and giving the vessel at least 40 fathoms of cable; for the sand is so very hard, that, with a short scope, you will certainly drift off the bank; then you have no bottom. If this should be the case, you must heave up immediately, and make sail again, to get on the bank.

I anchored here one fine night about eleven p.m., let go my anchor in 5 fathoms, gave the ship 30 fathoms of cable; she never looked at it, but drove off the bank. If it had not been a fine night, I should have been compelled to cut from my anchor. I would not recommend any commander to anchor on this ground with a chain cable; at any other part of the bay a chain is preferable. (This bank abounds with fish.) In the morning (if you have not by this time obtained a pilot), get under weigh at daylight, and steer for English Kay.

English Kay is situated on the South side of the channel, and is a small, low, sandy kay, with a few thatched houses on it, entirely shaded with trees. It is distinguished by a flagstaff 60 feet high, for signals, &c. On the opposite side of the channel, that is, on the North side, there is another kay of the same size, called *Goff's Kay*, that has some resemblance of a saddle; at about half a mile to the eastward of which is a little sand-patch, nearly even with the water, called, by the pilots, the *Sand Bore*. This is the place you must anchor at, for it is impossible for a stranger to proceed any farther without a pilot, as we have noticed on page 114.

In case the current or any other casualty should set you to the northward of Half-Moon Kay, and you fall in with the middle of the Southern Four Kays Reef, I would still recommend you to haul the ship to the northward, and go round the North end. On the North end of this reef is a kay, called, by the pilots, *North Kay;* after you round this kay, make all sail for Mauger Kay, the northernmost kay off Turneff: after you round Mauger Kay, steer S.S.W., and you will soon lift English and Goff's Kay; then anchor as before directed.

On Returning from the Bay, I would recommend your taking the pilot as far as Mauger Kay, as I have known many vessels run upon Turneff Reefs, owing to their having discharged the pilots at English Kay. Endeavour to leave Mauger Kay at the close of the day, so as to be the length of the Triangles by daylight. There is a very dangerous reef on the West side of the Triangles, that has picked up many ships.

The current, in general, sets rapidly to the westward, by the South end of the Triangles; a ship should, therefore, never attempt to pass to windward of this reef. On approaching the western edge of the Triangles, keep your lead going.

From the channel within Mauger Kay, if the wind is free, steer North; if not, steer N. by E. After you are to the northward of the Triangles, shape your course for Cape Antonio, according to the instructions given in the "*Colombian Navigator.*" From the Triangles the current runs from 10 to 30 miles per day to the northward: this I have ascertained from the mean of twelve voyages.

The Preceding Directions were given by the late *Captain Capes* as the result of many years' experience; but it may be observed that they make no distinction for the *Season of the Norths*, or northerly winds. The following, therefore, from the journals of *Mr. Dunsterville*, will be the more acceptable.

Directions for Sailing from Jamaica to Balize, in the Season of the Norths, or between October and March.

Take your departure from Pedro Bluff or South Negril, keeping near the parallel of 18° N. until you have attained lon. 87° W. Should you then get the wind from N.W. or N.N.W., which winds blow very strong, you will fetch Mauger Kay, the northernmost kay of Turneff, on the starboard tack. Keep well to windward, as the currents in these seasons set strongly to the southward.

Should the commander prefer going in by Half-Moon Kay, which is, to my astonishment, the route of many (because the lighthouse serves as a guide), let it be remembered that the prevailing winds will not, *in this season*, allow you to lay from Hat Kay Reef to Kay-Bokel; and it will also be a dead-beat from thence to English Kay: whereas, on

the route prescribed, there is a fair wind direct to English Kay, in a course about S.S.W. 6 leagues. The *Colombian Navigator*, which is an invaluable work for these seas, has been led into this error, directed you to make Bonacca in 16° 35', and those islands which lie contiguous; but these, being surrounded by dangerous reefs, and not surveyed, must perplex the mariner, with a strong southerly current and constant gales from the northward to N.W., and there being no port into which he can enter with safety, except Port Royal, in Ruatan. The latter is a most desirable place when you are in, but the entrance is particularly narrow and intricate between the reefs.

Half-Moon Kay, as already explained, is the S.E. kay of the Eastern Reef, and distinguished by a lighthouse on the East end. To the N.N.W. of this is *Saddle Kay*, about 3 miles distant, with a small clump of trees on it. W.S.W. of Half-Moon Kay is *Hat Kay*, which, with trees thereon, resembles a coronet. To 3 miles S. by E. from this kay extends a dangerous reef, even with the water's edge. The course to clear this reef, from 2 miles South of Half-Moon Kay, is S.S.W. ¾ W. about 10 miles. From the reef to Kay-Bokel the course is West, or W. ¼ N., according to the wind, 7 leagues.

Kay-Bokel may be known by its cocoa-nut trees, and a fine sandy beach. Rounding it at about half a mile, do not approach nearer, as the ground to the southward is foul. If you wish to anchor, bring the kay to bear from E. by S. to S.E. on a sandy bottom, with 10 to 4 fathoms. Give the ship plenty of chain; otherwise she may drag off the bank.

Should the wind blow strong from the East or N.E., between Kay-Bokel and English Kay, at the entrance of the channel to Balize, steer N.W. by W. 4 leagues. English Kay is sandy on the N.E. part, and is bushy to the water's edge on the South and S.W. sides. Goff's Kay, which is on the North side of the entrance, is much smaller, with a cocoa-nut tree on its centre, and is surrounded with a sandy beach. To the eastward of it, about half a mile, is the patch of sand called the *Sand Bore;* it is even with the surface, and, in rounding it, a great berth must be given. The anchorage is in 8 to 4 fathoms, Goff's Kay bearing from N. by W. to N. by E., or the kays to the northward and Goff's Kay in one.

There is also anchorage under Turneff, as far to the northward from Kay-Bokel as to bring English Kay N.W. by W. in 4 fathoms.

On English Kay, in general, the pilots live who pilot vessels coming in from the northward.

SAILING OUTWARD.—The course from English Kay to Mauger Kay is N.E. by N.; the distance between 6 and 7 leagues. This is the northernmost kay on Turneff; its latitude is 17° 36' 15", and longitude 87° 47'. A reef extends from it N.N.W. more than 2 miles. During two cruises in the bay the latitude was confirmed.

As the currents in this season run strongly to the southward, half a mile to three quarters of a mile in the hour, should it blow strong from the northward, on leaving English Kay, run out by the *Southern Four Kays*, as it is very dangerous to beat between Turneff and the main in a dark night. With N.N.W. winds, at this season, it is not unusual to pass out to the southward and eastward of the Triangle.

The DIRECTIONS for VESSELS bound to the EASTERN COAST of YUCATAN, from APRIL to SEPTEMBER, as given by *Mr. Dunsterville*, are as follow:—

Take your departure from Pedro Bluff, Jamaica, and pass about 2 or 3 leagues to the southward of the Swan Islands. These are two low bushy isles, which may be seen, in clear weather, 4 leagues off. Between them is a reef, over which the sea breaks heavily, and there is not space even for a boat to pass, from North to South, there being but 1 foot of water over the reef. On coasting along the North side, within a quarter of a mile, I found the coast very clear. About the westernmost island are spots of coral banks, but so clear to the shore as not to endanger a vessel: their extent, from East to West, is about 6 miles, the reef included, which extends from the West end about a mile and a half. There are two sandy coves on the northern side of the western island, and also on the southern side, where boats are safely landed. A current was, however, found on this and preceding days, setting to the N.N.W. about half a mile an hour. I found the latitude, by meridian altitude, 17° 24', and longitude of the East end, by chronometer, 83° 48' 50". At 2 miles from this point we had soundings on rocky bottom, with from 9 to 13 fathoms.

From the Swan Islands keep in the parallel of Half-Moon Kay, or 17° 12' N., or, as the current sets to the N.N.W., and should it be hazy weather, do not go to the northward of 17° 6' by account, as it would be very dangerous to fall in with the centre of the southern

Four Kays Reef at the close of the day. The breezes are generally strong from the eastward with a lee current. From Half-Moon Kay proceed as before directed.

In this season, if, on your return, you pass to the westward of the Triangles, you may find a current setting to the northward about 1 mile an hour; and it will be found that the winds often shift to the westward, with fresh breezes and rainy weather.

On a voyage of H.M.S. *Bustard* from Jamaica to and from the eastern coast of Yucatan, in June and July, 1827, Mr. Dunsterville made the remarks following:—

"From the West end of the Pedro Shoals to the Swan Islands, found the current setting to the W.N.W. about 1 mile an hour. These isles are between 3 and 4 miles in extent from E.N.E. to W.S.W., and may be approached (particularly by day) within 2 miles, in any class of vessel. The *Bustard* passed about a mile off shore on the North and South sides. On the S.W. point is a fine sand bay, where a vessel may cast anchor in from 10 to 7 fathoms; but, off the West end, a rocky bank extends full 1¼ miles, with very irregular soundings, from 10 to 5, 4, and 7 fathoms. When the weather is clear, this bank is easily discovered by the eye. Latitude of the East end of the eastern isle, 17° 24′; off this we had soundings in from 13 to 9 fathoms, rocky bottom, about 2½ miles, the East point N.W. ¾ W. No water could be found on the West isle, the swell being too heavy to admit our landing. Hence we proceeded toward Balize.

"At Belize the weather, during our stay, was heavy rains, with tornadoes from S.W. to N.W. These last for two or three hours, then subside into a calm."

On leaving Belize, the pilots are always ready to accompany vessels as far as *Mauger Kay*, and it is imprudent to discharge them sooner, as vessels have been known to run upon Turneff. Vessels from the Turneff Passage should leave Mauger Kay at the close of day, so as to reach the length of the Northern Triangle by daylight next morning if possible.

As the Triangle Reef is very dangerous, great caution is required in approaching it. Most vessels pass to the westward, as the current runs from 10 to 50 miles per day, particularly to the northward; and it generally sets rapidly to the westward, over the reef, and at the South end, on which there is a small sand-bore.

On approaching the southern and western part of the Triangle Reef keep your lead going. When well to the northward, make the best of your way for your destination, keeping a good lookout in order to avoid the Island Cosumel.

Vessels going out by the *Southern Passage*, that is, by the Four Kays of the Lighthouse Reef, should never venture without a pilot. In this case the pilot leaves the vessel at Half-Moon Kay, which is distinguished by the lighthouse.

"On passing the western side of the Triangle, upon returning from the bay, we steered N.N.E. and cleared the kays on the North part; and, having run 30 miles on that course, observed the latitude by the star *Spica*, 18° 35′ N. The current set to the northward about 1 mile an hour, and continued so till we arrived in lat. 22° 5′, and lon., by chronometer, 85° 24′ W."

From the N.E. end of the Isle Cosumel, Cape Antonio, the western extremity of Cuba, bears N.E. by compass [N. 52° E.] 125 miles. Upon this course allowance must be made, in the southern parallels, for the general indraught into the Mexican Sea to the N.W., and afterward for the Stream, which has too frequently been found winding from off Cape Antonio to the E.S.E., as explained in the *Colombian Navigator*, and the former part of the present work.

JAMAICA TO CHAGRE AND OFF CARTAGENA.

Copious Directions for proceeding from Jamaica to and upon the continental coast have been given in the *Colombian Navigator*.—(See vol. iii. p. 191, &c.) To that information we now add the following, from the Journal of Mr. Dunsterville, 1827.

"Sailed from Jamaica on the 18th of November: the weather fine, with light southerly sea-breezes. In standing across to Cartagena we found the current had set 34 miles to the westward in four days. On approaching land the weather was very hazy.

"We made the land of *Galera Zamba* [lon. 75° 25′ W.], which is low, and appears, at a distance, full of hummocks. To the northward of Point Canoas (more to the S.W.) the land is a little higher, and slopes gradually to the point, which is low, and should not be approached nearer than 2 miles.

"The hill called the *Popa of Cartagena* is very remarkable; it stands to the N.E. of the city, and has a convent on it. This is an excellent landmark; and to use the simile of other writers, like the quoin of a gun. From seaward it makes like an island. The city from the ocean has a fine appearance.

"We anchored, in the *Bustard*, on the Playa Grande, in 5½ fathoms, fine black sand, with the convent of the Popa E.S.E. ¼ E., Point Canoas N. by E., western extreme of Tierra Bomba S. ½ W. Latitude of the anchorage, 18° 28′, off the town 1½ miles, longitude, 75° 34′. From hence to Chagre, light winds from E.N.E. to North: hazy weather.

"*On approaching the land near Porto Bello* [Velo] we experienced strong N.E. currents 1½ miles an hour, and which continued until we arrived off Chagre. Therefore, at this season, keep well to the westward, if the winds are light; but if the strong N.N.E. winds have set in, which commence at about this time, make the land well to the eastward, it not only affording a better landfall, but the currents then run more rapidly to the S.W.

"*In the vicinity of Chagre* the land presents nothing very remarkable by which it may be known, particularly if the weather be hazy, and the castle cannot be seen when it bears to the southward of S.E. by S. This castle is situate on an eminence commanding the village and river, and mounts about 20 guns.

"The *Bustard anchored* in 5¼ fathoms, with the flagstaff of the castle S.E. ½ E., Point Brujas N.E. ¾ N., off shore, three-quarters of a mile. To the southward of the point is a large white patch in the rock, with a fall of fine fresh water close to it.

"Supplies, water excepted, cannot be obtained here. Fowls were a dollar a-piece, and scarce.

"In turning down the coast, from Brujas Point to Chagre, which is 1 league distant, the shore seems bold; but do not shut in the Point with the southern land. The best anchorage for a large ship is with the Point N.E. about 3 miles off. A strong current out of the river runs to the N.N.E., 2 miles an hour at the anchorage, therefore you cannot ride heavy at the anchor; but the vessel rolls heavily when strong winds blow. We weighed and beat to the eastward for *Porto de Naos* or *Navy Bay*, on the N.E. side of which, under Manzanillo Island, a vessel will be well sheltered from N.E. and N.N.E. winds. This bay is formed by *Manzi Point*, the N.W. extremity of the Island of Manzanillo, and on the West by *Toro Point*. These points lie nearly 3 miles from each other. Toro Point has a very dangerous reef, extending nearly a mile to the N.E., which should not be approached nearer than in 6 fathoms. Manzi Point is bold; it has 5 fathoms within half a cable's length, and under it is the best anchorage, at the present season of N.E. winds, in 4 or 4½ fathoms, with Manzi Point North or N. by E. about a quarter of a mile. From the point off shore are 520 yards of good ground. To the distance of a mile or a mile and a half from the entrance the shores are bold, with 3 fathoms close to the beach, and soundings regularly decreasing from 6 to 4 fathoms. You may, therefore, take an anchoring berth at pleasure, suited to the vessel's draught. This place does not produce supplies of any kind: even water is to be found only in a few stagnant pools, from heavy rains, and is very bad.

"In the season of the rains the best place to anchor in is on the western side, as winds prevail from that quarter. There is a hut on *Point Limon*, in the S.W. extremity of the bay, and which is very high in comparison with the adjacent coast: when it bears S. by W. you will be to the eastward of Toro Reef, and may run into the bay. From this point there is a communication by a pathway to Chagre. Occasionally two or three soldiers are kept there for the suppression of smuggling. Cocoa-nuts are in great abundance; fish very scarce. The soundings on the coast, from 1 mile North of Point Toro, to the same distance off Point Brujas, are 7½, 8, 8½, 9, and 10 fathoms; and from Brujas Point to Chagre, 10, 9, 7, 6½, 6, 5½, off shore about half a mile, keeping Brujas Point open, bearing N.E. or N.E. ½ N."

JAMAICA TO THE BAR OF MARACAYBO, APRIL AND MAY, 1827.

On sailing from Jamaica we had fresh easterly winds and squally weather, then winds variable round the compass.

From Alta Vela, in lat. 17° 28′ N., lon. 71° 41′, we took our departure for the Isle of *Oruba*, on the eastern side of the Gulf of Maracaybo, allowing for the strong westerly currents about three-quarters of a mile an hour.

Saw the *Monks*, which are rather high rocks; and, by the altitude of the star *Antares*, made the northern one to lie in lat. 12° 28′. Hauled to the S.E., and ran along the western coast of Paraguana, sounding, when distant from the shore about 3 miles, from 12 to 8 fathoms, till we arrived at *Punta de los Estanques*, whence we took our departure for the Bar of Maracaybo, S.W. ½ W.

To the eastward of the Bar of Maracaybo, about 8 leagues, are high mountains; the land westward of these is low, and continues so, with occasional breaks in it, by kays and hillocks, which are at the entrance of the lagoon. Farther westward are two pieces of land, not particularly high, on the low S.E. termination of which are three little hillocks. This is the *Isla Todos*, on which stands the Castle of San Carlos. When bearing S.S.W. ¾ W. the hillocks are over the fort, which is white. Do not steer for the latter, but continue on about West, not going into less than 5 or 5½ fathoms, when you will open the ruins of Fort Zapara to the southward, and the Castle of *Bajo Seco* to the westward, in lat. 10° 59′, lon. 71° 42′. This fortress is, likewise, white, and is situate on a small sandy kay. To the westward of this lies the bar, having at this season a depth over it of only 11 feet, hard bottom; but in the rainy season, August, September, and October, there is, at least, 13 feet of water.

The breezes here are very heavy from the N.N.E. to N.E. by E. in the early part of the year; yet at about 8 a.m. the wind is generally more moderate; and from 2 p.m. to 2 a.m. in the following morning it blows a perfect gale, with a heavy sea, so that it is dangerous to lie at anchor here.

The best anchorage off the bar is in 5 or 5½ fathoms, with the Castle of Bajo Seco South or S. by W.; off shore about 3 or 4 miles. The soundings on the South side of the gulf [bay?] are regular, decreasing gradually as you approach the shore. The current runs to the N.E. when the moon rises; and it is high water, on the full and change, at 5^h 15′.

In beating to windward, endeavour to be near the north-western shore at about 1 p.m., in order to take advantage of the winds which draw to the N.N.E., so as to make a good lay to the eastward.

The communication with the city of Maracaybo is kept up by one of the ship's boats, hiring a pilot for the occasion, who, on making the general signal, will come out from Bajo Seco in a boat with latine sails, should the weather be moderate. If you have to communicate frequently with the city, or to cruise in the gulf, I should recommend beating up to the anchorage of Estanques, in the peninsula of Paraguana; but, in beating up, do not go to the eastward of Punta Gorda, the S.W. point of Paraguana.

The *Anchorage at Estanques* is very good for a vessel of the largest class, even within half a cable's length of the beach, and capable of containing twenty sail in safety. The best marks for assisting a stranger to find the anchorage is the Mountain (or Pan) of *Santa Anna*, which much resembles Vesuvius, and may be seen, in clear weather, 8 or 9 leagues off. This mountain, when bearing E. ¼ N., leads to the anchorage. The place may also be known by being a long tongue of sand, with some huts on the extreme point, occupied by fishermen, who, in the season, take immense quantities of fish by the seine. The *Bustard* anchored in 4½ fathoms, and veered to 25 fathoms on the N.E. anchor (from which quarter the prevailing winds come strongly), and 82 fathoms on the best bower to the S.W. Point Estanques, S. ¼ E., Point Salines, N.N.W. ½ W., off shore 2 cables' length. No supplies can be obtained here. Rabbits may be shot, but can be purchased cheaply. The little water that may be procured is muddy, and not fit to drink.

If you are bound to the eastward, when clear of the gulf (bay?) stretch to the northward, as the currents run so strong between the Isle of Oruba and Cape St. Roman, that it is nearly impossible to beat through; but, should you go between the island and main, be cautious in standing by night to the S.E., as the coast from Cape Roman to Aricula (S.E. 19 miles) is very dangerous, and the currents thereon.

In stretching across, from *Point Chicabacoa*, on the West side of the mouth of the gulf, to Jamaica, we found a strong current, running due West, nearly 1 mile an hour.

THE CHANNELS OF PROVIDENCE.

The Channels of Providence, between the Great and Little Banks of Bahama, are copiously described in the second volume of the *Colombian Navigator*, as well as the

winds and seasons of this portion of the West Indies. In pages 92 and 94 of the present work we have also given descriptions of the new lighthouses on Gun Kay, in the Florida Strait, and upon the South end of Abaco, which are eminently useful in facilitating the navigation, more especially since the extinction of the light near Cape Florida, on the opposite side of the stream. We have been assured, by an intelligent navigator, that it is not unusual for twenty sail of vessels, of from 100 to 400 tons burthen, to pass the Great Stirrup Kay within musket-shot, and even within hail, in one day; these, for the most part, proceeding from the United States to Cuba and the Mexican Sea. They make the Hole in the Wall, now distinguished by its lighthouse, then the Stirrup: thence, if the weather appears threatening, they pass through the N.W. channel; otherwise they shape a course, picking their way, across the Great Bahama Bank, to the southward of the Cat Kays, beyond the Gun Kay Lighthouse. Here they enter the Florida Strait, and pursue a southerly course, where the Gulf Stream is found, as described, to run with the least velocity to the northward.—(See farther, *Colombian Navigator*, 1848, vol. ii. pp. 223 to 226)

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3. DIRECTIONS FOR PROCEEDING TO DEMERARY, ETC. FROM THE N.E.

In the third volume of the *Colombian Navigator*, pp. 128 to 160, we have given a copious description of the coast, and directions for making the rivers, of Guyana. To that description, &c., the following remarks in addition, by Captain *George Chevley*, written in 1831, will be found a useful and valuble addition: see, also, the Notes on Guyana, in the present volume, pp. 112, 113.

"If, when in lat. 10° N., the water changes to a dark or black colour, or dirty drab, and then in 8° turns again to the usual sea blue, you may rely on being to windward. There are no soundings, only this remarkable change.* You will then, in running farther in, on the coast, observe a perfect division, or line of change, on the water, nearly N.W., from blue to green, where the current sets strong in that direction. On proceeding, you will again change to thick muddy water, influenced by the tides, which should be carefully calculated and allowed for. Many ships have run to leeward from want of this, and a due allowance in the course when the tide is running, which is always with the flood. As you approach in-shore 4, 5, and 6 fathoms, should the water then be of a *red* colour, you may make sure of being to windward, and need not fear running, even should you obtain no pilot. This is most perceptible from Miconie down to Corobana Point: to leeward all is dirty, thick mud.

"The lighthouse on the weather point of the Demerary River shows a bright fixed light to seaward, from 12 to 14 miles; with this light-tower bearing from South to S. ¼ W., flood making, you cannot do wrong by steering in on that course, should you not obtain a pilot, and come-to off the fort, keeping outside the poles on the West side. I mean this as a safe plan for a stranger.

"The deepest part of the channel has worked of late much to windward; and deepened so as to allow vessels of 17 and 18 feet draught to beat out in two or three tides. I ran in without a pilot in April, 1830; was on the bar at dead low-water spring tides, least water 2 fathoms, and am convinced 11 feet may always be found. The pilots, of course, wish the bar to be thought shoal and dangerous, and endeavour to keep in ignorance those who should make these things more a matter of study than is at present the case."

To the preceding we now add the following, obligingly communicated by Captain *Wm. Cook*, of the *Highbury*, of London, 1834.

Ships from Europe, bound to Guyana, on arriving in about the lat. of 10° N., lon. 48° to 50° W., will suddenly find the water change from a light blue to a dark green colour (no soundings with 130 fathoms of line), with every visible appearance of a strong current. This current, from repeated observations, I have found setting to the northward at the rate of a mile and a quarter per hour; and, in the months of August and September (after the rainy season), I have found it to set about N.N.E. at the rate of 2

* This discoloured water appears to be in the Stream of the *Equatorial Current*; as may likewise be that which is met with at 80 or 100 leagues to the East of Barbadoes.—ED.

miles an hour. I consider this current to be caused by the stream of the River Marañon; for as you proceed to the S.W., the water again resumes its usual colour, and the current takes a more westerly direction, until you reach the edge of the Bank of Soundings, where it takes the direction of the line of coast, and runs about 1½ miles in the hour, excepting during and immediately after the rainy season, when it runs at the rate of from 2 to 2½ miles an hour.

Strangers bound to Demerary or Berbice (if not quite certain of their longitude) should avoid making the land, and endeavour to gain the parallel of 6° 30′ N., before going to the westward of lon. 56°. The course then is W. ½ S. by compass. To the eastward of the River Corentyn, in this parallel, you will have from 18 to 20 fathoms of water, dark sand, with broken shells and mud; when abreast of the Corentyn, you will have 12 fathoms, with clean brown sand. Steering the above course, you will gradually shallow your water to 7, 6, and 5 fathoms, soft mud, when you may be sure that you are approaching the Bar of Berbice.* If it be daylight, you will see the land, which is very low. If in the night, and you are bound to Berbice, I would advise the ship to be brought to anchor.

If bound to Demerary, the better way will be to stand to the northward by the wind until daylight, as there are several dangerous mud-flats between Berbice and Demerary, some of which extend 6 or 7 miles off the land, and shift occasionally.

WINDS.—During the day, throughout the greater part of the year, the prevailing winds on this coast are from the N.E. to N.E. by N. During the months of June, July, August, and September, the wind generally draws more to the eastward after sunset, and continues blowing light until about 9 o'clock in the morning; when it again backs to the N.E., and blows a fresh breeze.

CURRENTS.—Within 15 miles of the coast the tide regularly ebbs and flows six hours each way; the flood running westward, and ebb to the eastward. Without this range the current [Equinoctial] runs constantly in the direction of the coast, from 1 to 2 miles an hour. In sailing to the northward you will find the current, when about 60 miles from the coast, to run about N.W., and in this direction it continues to run until you are to the northward of the islands.—(*See page* 219.)

"The velocity of the current between the coast of Guyana and the islands is modified by circumstances, which I have never been able satisfactorily to account for, as I have often found it imperceptible, at other times very strong, and not in the least influenced by the seasons."

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4. OF SHIPS BOUND TO AND FROM NORTH AMERICA ONLY.

In the introductory remarks to this section of the work, we have alluded to the principles of great circle sailing, and have pointed out the advantages which it possesses, not so much in the shorter distance which it gives over the rhumb course, but in the scope it allows the navigator in the choice of a parallel on which he can make a good passage, without materially increasing the actual distance to be sailed over.

In no case can this be better exemplified than in the courses over the northern parts of the Atlantic, between the British Isles and the northern American ports. We alluded to a case, not impracticable, of the courses between the Lizard and Cape St. John's, in Newfoundland, and showed that two courses might be taken, not more than 35 miles greater than the shortest distance, of exactly the same length, and yet be 330 miles apart in latitude in their greatest separation.

An *imaginative* course will well explain this for our present purpose:—From the Lizard to Sandy Hook, New York, the distance and course by compass are 2,952·5 miles S., 78° 51′ W. But if a vessel leaving the Lizard were to commence sailing N., 73° 24′ 40″ W., and passing about 35 miles southward of Cape Clear, gradually bearing to the West,

* Since the 5th of February, 1840, a light-vessel has been stationed off Berbice, in 2½ fathoms at low water, with the eastern point of the entrance bearing S.S.W. distant 10 miles. It exhibits a single bright light, from sunset to sunrise, and by day a black ball at the mast-head. For the light-vessel of Demerary, see the note 7, page 113. It may be prudent not to depend too much on seeing these vessels when passing.—ED.

attaining a maximum latitude of 51° 56′ 30″, lon. 26° 27′ 20″ W., and then, if it were possible, approach New York on a S. 54° 36′ W. course, she would sail over 2,865 miles, or 87½ miles less than the compass course. This *great circle course* passes over Cape Bonavista and La Hune Bay in Newfoundland; St. Anne's Bay in Breton Island; Pictou and Cape St. Mary in New Brunswick; near Boston, New London; and over Long Island, in the United States.

A line, of the length of 2,952·5 miles, placed in a higher latitude than the rhumb line, as shown in page 268, is just as much *above* the great circle course in latitude as this is above that by compass. This corresponding arc from New York leads considerably inland of the coast of the Eastern States, intersecting Chaleur Bay, Cape Bonaventura in Gaspé Bay, Anticosti, passes 45 miles N.W. of the Strait of Belle-Isle, approaches within 189 miles of Cape Farewell, Greenland, attains a maximum latitude of 57° 12′ N., and intersecting the S.W. part of Ireland, at Kinsale, reaches the Lizard in a S.E. direction. These two lines, of the rhumb and the corresponding arc, are *upwards of 700 miles apart* at the greatest deviation from each other.

With these considerations so manifest, we shall be better prepared to understand that a higher latitude than the usually received one cannot, of itself, be disadvantageous; and the excellent observations of Captain Hare, presently given, will be more clearly evident.

By referring to the Chart, it will be seen, that from the Land's End of England to St. John's, Newfoundland, the true bearing is W. 4° S.; and from the same point to Cape Sable, or the S.W. end of Nova Scotia, it is about W. 9° S. But the circumstances of navigation, in general, render a direct course more tedious and difficult than a circuitous route; and the best passages have been made by pursuing a *high northerly course*.

It seems probable, from all that we have said on the winds and currents, that on prosecuting a north-westerly course, from the Bank of Channel Soundings, the winds and currents, respectively, may counteract and balance each other; that, on further prosecution of the same course, the winds will be found less westerly, and therefore more favourable than in the more southerly parallels; and that, in advancing toward the mouth of Davis's Strait, the advantages both of wind and current may be combined.

Caution must be taken not to advance too near the eastern coast of Newfoundland, if bound to New Brunswick or the southern ports; nor to the eastern coast of Breton Island, as here the vessel may be swept round by the strong westerly currents, which have been described on the preceding pages (252, 254), and which, now understood, instead of producing mischief, may prove highly advantageous in facilitating the ship's course.

The propriety of these arguments was confirmed by experience, in more than forty passages made to and from New Brunswick, &c., by Lieut. Chas. Hare, of the Royal Navy, previous to the fall of 1824. Annexed is a copy of that gentleman's communication.*

"Ships from Scotland, in the spring of the year, and bound to New Brunswick, have always arrived sooner than those from the English Channel; which is attributed to their being more to the northward on leaving the land.

"Ships from Liverpool generally arrive before those which sail from the English Channel; the cause being the same.

"In the SPRING of the year, I would never go to the southward of lat. 46° or 47°, until I reached lon. 37° or thereabout; then edge to the southward as far as lat. 43°, in order to avoid the icebergs, keeping a very strict lookout; this parallel (43°) I should endeavour to preserve, or nearly so, but nothing to the southward, until up to Cape Sable, Nova Scotia; for it carries you to a safe and proper distance from Sable Island, a place that cannot be too much dreaded. In this track you will be without the northern edge of the Gulf Stream, and assisted by a south-westerly current from the Banks until past that island.

"In the FALL of the year my track is far more to the northward than in the spring. On leaving the land as late as the middle of October, or thereabout, I generally steer to

* Many succeeding passages made by Captain Hare, since 1824, have concurred to prove the propriety of these directions, which have been highly approved by the American captains of home ships, as well as by British masters. This gentleman had crossed the Atlantic for the ninety-eighth time, in the year 1839, and the *one hundred and eleventh*, in 1846.

the north-westward until I get as far North as 55°, and until I enter the longitude of 30°, then edge to the southward, to enter the banks in lat. 46°, shaping again a course to pass about 60 miles to the southward of Sable Island, as above. If bound to Halifax, and very sure of my latitude, I might be tempted to pass to the northward of Sable Island; but, at all events, it would be at great risk; and I should not, under any circumstances, recommend a stranger to attempt it; as the weather is mostly foggy, and the set of the currents unaccountable. The soundings on Banquereau are incorrectly laid down in every chart that I have yet seen; being, in fact, within an hour's sail of the N.E. bar of Sable Island; from which cause I once very narrowly escaped shipwreck. Numerous gannets are always hovering about this island, and are a very excellent indication of your near approach to it, particularly on the South side.

"By crossing the banks thus far North, you will find the advantage as you approach the longitudes of Newfoundland and Nova Scotia; the strong N.W. and North gales having then commenced, you will frequently be compelled to lie-to for two or three days; and should then ensure sufficient drift, before you are blown into the strong influence of the Gulf Stream; which would be the case at a few degrees to the southward, and inevitable in a S.S.E. direction, at an inconceivable rate. Last November (1824) the case occurred; the vessel being hove-to, under main-topsail and storm-trysail, to the westward of the banks, in lat. 45°, and was, in four days, swept into lat. 39½°, consequently into the Gulf Stream, when the longitude became also considerably affected, and I took the first opportunity of making a N.N.W. course, to get out of it as soon as possible.

"To prove the advantages of a northern track, late in the fall of the year, I may notice that I have, in one or two instances, read, in the American newspapers, the accounts of very long passages experienced by ships which met heavy gales in the latitudes of 35° and 38°, when several vessels were disabled, and others suffered loss of sails; yet, *on the same day*, in lat. 54°, I had moderate weather from the N.N.E., with top-gallant studding-sails set; which strongly encourages me to believe that the blowing weather, incident to approaching winter, commences southerly, and inclines northerly as the season advances, and not the reverse; an hypothesis generally formed by English ship-masters, but, in my opinion, certainly erroneous.

"I am farther of opinion that the influence of the Gulf Stream, in the parallels from lat. 35° to 42°, whether from the warmness of the water or other natural causes, has a strong tendency to attract the wind from a western direction; as I have invariably found the wind more alterative in the northern latitudes before mentioned than the southern ones; and it unquestionably must be allowed, by all mariners of any observation, that gales experienced in the Gulf Stream, or its vicinity, blow with much greater violence than they do in that part of the Northern Atlantic not under its influence;* besides, the squalls from the southward or S.W. are much more sudden and heavy, and near the banks they are attended with dangerous lightning. The thermometer (an instrument easily understood) is of the greatest importance for ascertaining your approach to it; and, if bound to the West, I would, for my own part, endeavour to avoid its effects as cautiously as I would a lee-shore; for it may be depended on, that no ship, however well she may sail, will effect westing in the Gulf Stream with a wind from that quarter; and it is to be remembered, that its velocity is accelerated according to the strength of those winds; and its extent in breadth, at a few degrees to the westward of the Azores, is many more degrees than is commonly supposed.

"These observations, I hope, may be useful to my brother mariners engaged in these voyages; and, permit me to say, that they are grounded on the experience of more than forty times crossing the Atlantic, in his Majesty's and the merchant service, and in the command of vessels in both; latterly in one of nearly 400 tons burthen, the *Waterloo*, owned in St. John's, New Brunswick; and, as the custom-books in Liverpool can testify, landed four full cargoes in thirteen following months; which, including the time required to discharge the same, then load outward to St. John's, there discharge and load home again, leaves but very little time for the ship to cross the Atlantic eight times in fourteen months, which, in fact, was done.

"Still farther, in corroboration of my approved northern track, allow me to observe, that in the fall of 1823, by keeping in a high latitude, the brig *Ward*, myself master,

* See the remarks upon the Gales of the Azores, in the description hereinafter given of those islands.

also owned in New Brunswick, performed a voyage out and home in seventy-two days. The same vessel likewise, on the 3rd of October, 1824, left the English Channel, and arrived again in the Downs on the 3rd of January following.

"I must add, that a strong, well-found, and well-manned vessel, alone can perform these voyages; for they must be maintained with unremitting attention and perseverance.

"The necessity and propriety of the above remarks were particularly exemplified by the *Ward*, which, on her passing through the Downs, in 1824, left ships there which were bound to the westward, weather-bound, and found them there on her return, having been driven back by adverse winds; while she, getting out of the Channel, performed with ease a prosperous voyage to St. John's, New Brunswick, and back, exactly in three months, assisted by chronometer, thermometer, &c."

Although the voyage to and from North America, between the parallels of 60° and 40°, has always been attended with a degree of peril, from masses of ice which drift to the southward, during the summer months, from the polar regions, yet many an unwary mariner makes his run across the Atlantic without any apprehension of meeting these floating dangers, or without sufficiently exercising a proper discretion and vigilance to guard against coming in collision with them. Commanders of ships should, therefore, bear in mind the imperative necessity there is for using their utmost vigilance and attention when crossing the above-named parallels, especially between the meridians of 30° and 60° W., to guard against coming in contact with these formidable dangers of the ocean. Upon the subject of the ices which come down from the northern latitudes, much that is interesting and necessary to be known will be found in a subsequent part of this book.

The *New York packet-ships*, well supplied with every essential equipment, and elegantly fitted for the accommodation of passengers, when making their winter voyage from Liverpool, keep in high latitudes until nearing Newfoundland. This they do for the twofold object of avoiding the tempestuous weather so generally experienced to the southward, and of obtaining fairer winds; and thus, by slipping within the mighty stream from the Florida Channel, they evade its retarding influence. The voyage by this route is shortened; and, although bad weather must be expected, it is not so violent as farther South; besides which the eastern currents are avoided.*—(See farther on this subject, *Colombian Navigator*, vol. i. p. 219.)

LIEUTENANT MAURY'S SAILING DIRECTIONS.

The Bureau of Ordnance and Hydrography, in the National Observatory of Washington, United States, have published (in 1848) a series of Wind and Current Charts of the Atlantic Ocean. These works, drawn up under the superintendence of Lieutenant *M. F. Maury*, A.M., U.S.N., exhibit, in a peculiar form, the result of an immense series of observations on the winds, &c., collected from a large number of logs, and arranged systematically for the practical use of mariners.

We cannot pretend to give here a notion of this chart, embodying, as it does, such a vast mass of materials, which, though placed in a tabular form, has a degree of complexity that, in our opinion, will cause great embarrassment in their use. Still, by the patient investigation of the data they afford, beyond doubt much light may be thrown on the probable best track for favourable winds.

The chart is divided into squares of 5° latitude and longitude each, and in each of these squares are arranged the various directions of the winds, or calms, as actually observed for each month of the year. By careful comparison of these diagrams, Lieutenant Maury has laid down certain tracks as the best to be followed in each month between New York and Europe. Without presuming to criticize on these tracks, the superiority of which can only be tested by an average from trials, it certainly seems to us

* The advantage of sailing in a *higher* latitude is not confined to the superiority of favourable winds and currents. The great circle from the Lizard towards Cape Race, Newfoundland, commences W. 12° 47½′ N., and its vertex is in lat. 51° 9′ N., lon. 21° 43′ W., distance 1,928 miles. The rhumb course, S. 84° 4′ 50″ W. and N. 84° 4′ 50″ E., is a few miles longer; but what we have termed the "corresponding arc" attains a latitude of above 53° 50′, and is 320 miles apart from the rhumb course, thus differing not very widely from that proposed by Captain Hare.

that they apparently diverge so much from any regularity of order in different months, not exhibiting any gradual change with the seasons, as might reasonably be expected, but have a general zigzag course, at variance with the generally received laws of simplicity and order which natural phenomena assume. Still, as has been before stated, it is not intended to cast any imputation as to the correctness of the views advanced, but by here detailing them, to allow those into whose hands these remarks may fall to give them their due weight in their selection of a track.

It is our intention, at an early day, to attempt to generalize these observations in combination with those previously made by Rennell and others, and to endeavour to draw out thence some less complicated system for the use of mariners.

To revert to Lieutenant Maury's "Sailing Directions,"* as founded on these charts. In this the best routes between Europe and New York are indicated for each of the first four months of the year; and for this 13,362 observations, during these months, made in the line of these tracks, have been discussed.

"Though they be approximations to those routes which further investigations, based on more ample materials, may establish, their importance will, no doubt, be readily appreciated, when it is considered that the average per centum of calms, head and fair winds, is stated for each district of the ocean through which the vessel is recommended to pass."

The following tables, therefore, show the best average routes in January, February, March, and April, between New York and lon. 10° W. for vessels bound to or from Liverpool, also between New York and lon. 5° W. for vessels bound in or out of the English Channel.

In these tables the first three columns explain themselves. Column four shows the actual distance between the two points indicated.

Column five shows the *probable* distance to be sailed over on account of adverse winds.

The ensuing columns refer to the *winds*. Column six shows the average *per centage* of winds *dead ahead*. Column seven shows the average per centage of *fair* winds. The remainder of the average being made up with slants from northward or southward. Column eight shows the relative number per cent that *calms* bear to that of winds.

NEW YORK TO EUROPE.

January. — **February.**

January: Lat.	Lon.	Courses.	Distances: True.	Distances: Average.	Winds, per cent: Head.	Fair.	Calms.	February: Lat.	Lon.	Courses.	Distances: True.	Distances: Average.	Winds, per cent: Head.	Fair.	Calms.
40° 28′	74° 00′	to						40° 27′	74° 00′	to					
40 28	70 00	E.	182	193	6·2	82·8	2·1	40 45	70 00	†E ½ N.	182	198	1·0	79·5	1·9
42 02	65 00	E.N.E.	245	271	2·8	78·3	3·6	41 42	65 00	E. by N. ½ N.	233	252	3·4	84·7	6·6
43 33	60 00	E.N.E.	238	287	8·0	65·4	3·2	43 13	60 00	E.N.E.	238	251	0·0	79·6	0·0
43 33	55 00d	E.	217	226	0·0	84·6	4·4	44 42	55 00	E.N.E.	234	259	2·2	73·8	7·8
45 03	50 00	E.N.E.	233	266	4·8	73·6	8·5	44 42	50 00d	E.	213	232	3·3	81·3	2·3
45 03	45 00	E.	212	236	0·0	71·4	0·0	44 42	45 00	E.	213	228	0·0	79·0	2·9
45 28	40 00d	E.	212	226	0·0	78·3	0·0	45 00	40 00	E. ½ N.	212	225	2·8	93·0	4·4
45 27	35 00	E.	212	223	1·5	91·0	9·2	46 26	35 00	E.N E.	225	238	0·0	77·6	3·1
46 30	30 00	E.N.E.	227	246	2·2	78·0	2·1	47 50	30 00	E.N.E.	221	239	1·0	79·0	4·9
47 55	25 00d	E.N.E.	221	233	0·0	82·0	7·0	49 13	25 00	E.N.E.	217	225	0·9	91·9	4·3
47 55	20 00	[illegible]	201	217	1·5	77·5	3·1	49 13	20 00d	E.	197	216	3·0	81·0	4·0
49 17	15 00	E.N.E.	214	219	0·0	90·2	2·8	50 00	15 00	E. by N. ½ N	200	217	4·2	86·0	1·4
50 00†	12 20	E.N.E.	113	120	2·1	89·7	0·0	50 50†	10 00	E. by N. ½ N.	196	217	3·6	74·8	3·5
50 38†	10 00	E.N.E.	98	112	5·8	76·7	1·9								
			2885	3075							2781	3015			
49 17‡	10 00	E.	196	212	4·2	91·6	0·0	49 30‡	10 00	E. ½ S.	200	[illegible]	5·7	63·9	1·9
49 36‡	5 00	E. ½ S.	196	245	8·3	50·2	0·0	49 30‡	5 00	E.	195	214	0·0	66·8	0·0
			3007	3500							2984	3245			

* *Notice to Mariners*, Washington, Jan. 1, 1850. † To Liverpool. ‡ To the Channel.

MARCH.

Lat.	Lon.	Courses.	Distances. True.	Distances. Average.	Winds, per cent. Head.	Winds, per cent. Fair.	Winds, per cent. Calms.
27	74° 00′	to					
27	70 00	E.	182	205	6 2	84 1	4·1
00	65 00	E.N.E.	245	263	7·2	71·9	1·4
45	62 30	E.N.E.	119	134	4·5	69·3	4·1
[illegible]	60 00d	E.S.E.	119	135	4·2	69·7	
31	55 00	E.N.E.	238	269	9·6	68·2	5·3
31	50 00	E.	217	234	1·9	79·4	0·9
31	45 00	E.	217	238	1·7	79·5	2·5
31	40 00	E.	217	225	1·6	93·1	5·0
31	35 00	E.	217	224	0·0	89·5	4·8
00	30 00	E.N.E.	233	250	1·3	75·4	3·9
27	25 00d	E.N.E.	226	244	4·4	90·1	1·1
27	20 00	E.	206	212	0·0	90·8	2·2
52	15 00	E.N.E.	221	236	0·0	81·1	0·0
00	11 43	N.E.	181	191	0·0	84·0	0·0
14*	10 00	N.E. by E.	81	90	5·4	80·6	3·5
			2919	3150			
00†	10 00	E.	67	73	3·0	79·0	0·0
10	5 00	E. ½ S.	194	213	17·0	49·7	0·0
			3099	3348	259		

APRIL.

Lat.	Lon.	Courses.	Distances. True.	Distances. Average.	Winds, per cent. Head.	Winds, per cent. Fair.	Winds, per cent. Calms.
40° 27′	74° 00′	to					
40 27	70 00	E.	182	199	3·0	76·0	7·1
42 00	65 00d	E.N.E.	244	274	3·2	77·4	2·5
42 00	60 00	E.	223	251	5 2	77·9	7·3
43 31	55 00	E.N.E.	237	256	2·4	85·5	4·1
45 00	50 00	E.N.E.	233	244	0·0	82·9	10 1
46 21	45 00d	E.N.E.	226	233	0·0	91·7	0·0
46 27	40 00	E.	207	320	0 0	78 0	5·6
46 27	35 00	E.	207	218	2·5	92·5	7·6
46 27	30 00	E.	207	228	0·0	70·3	5·5
47 52	25 00	E.N.E.	221	255	5·2	66·7	7·4
49 14	20 00d	E.N.E.	215	242	4·2	78·2	5·9
49 14	15 00	E.	196	213	3·6	79·6	7·5
49 14	10 00	E.	196	205	1·1	90·1	0·0
49 30*	5 00	E. ½ N.	196	237	5·5	50·5	5 6
			2990	3275			
50 00†	13 06	E.N.E.	79	82	1·1	89·0	0·0
Cape Clear	10 00	E.N.E.	130	136	0 0	92·8	0 0
			2807	3051			

* To the Channel. † To Liverpool.

EUROPE TO NEW YORK.

JANUARY.

Lat.	Lon.	Courses.	Distances. True.	Distances. Average.	Winds, per cent. Head.	Winds, per cent. Fair.	Winds, per cent. Calms.
30′*	5° 00′	to					
30	10 00	W.	192	192	0·0	100·0	0·0
30†	15 00d	W.	192	250	12·6	53·8	0 0
40	10 00	to					
30	15 00d	W. by S. ½ S.	202	275	16 5	50·5	2 9
08	20 00	W.S.W.	213	293	14·0	31·4	2 8
45	25 00	W.S.W.	219	272	9 0	61 0	3·1
18	30 00	W.S.W.	226	292	10 8	47 2	7·0
18	35 00	W.	211	259	6·6	57·0	2·1
18	40 00	W.	211	270	9·0	50·5	9·2
49	45 00	W.S.W.	232	276	5·5	59·3	6 8
49	50 00d	W.	215	256	4·4	61·5	0·0
19	55 00	W.S.W.	237	277	3·6	64 0	8·5
46	60 00	W.S.W.	244	298	5·5	53·5	4·4
46	65 00	W.	225	261	6 4	66·0	3 2
46	70 00d	W.	225	285	9·1	53·2	3 6
27	74 00	W. ½ S.	183	226	9 0	57·0	2·1
			3025	3707			

FEBRUARY.

Lat.	Lon.	Courses.	Distances. True.	Distances. Average.	Winds, per cent. Head.	Winds, per cent. Fair.	Winds, per cent. Calms.
49° 00′	10° 00′d	to					
47 38	15 00	W.S.W.	216	237	1·9	77·2	1·9
47 38	20 00	W.	202	239	6 6	63·6	1·4
47 38	25 00	W.	202	235	4·0	60·	4·0
47 38	30 00	W.	202	242	6·3	51·1	4·3
46 12	35 00	W.S.W.	225	275	4·0	45·0	4·9
46 12	40 00	W.	208	269	11·2	56·8	3·1
46 12	45 00	W.	208	244	3·0	57 7	1 5
44 44	50 00d	W.S.W.	230	242	0·0	63·6	9·0
44 44	55 00	W.	213	264	8 8	52 7	2·3
43 15	60 00	W.S.W.	234	275	4·4	62·6	7 8
41 44	65 00d	W.S.W.	239	288	6·0	55·0	0 0
40 44	70 00	W. by S. ½ S.	233	290	8·5	52·4	6·6
40 29	74 00	W. ½ S.	184	204	0·0	65·4	1·9
			1798	3305			

* From lon. 5° W. † From lon. 10° W.

March.

Lat.	Lon.	Courses.	Distances. True.	Distances. Average.	Winds, per cent. Head.	Winds, per cent. Fair.	Winds, per cent. Calms.
49° 30′*	5° 00′	to					
50 00*	6 54	W.N.W.	79	85	0·0	75·1	0·0
50 49	10 00	W.N.W.	128	147	3·0	69·0	2·7
50 00	13 06	W.S.W.	128	161	10·0	55·6	3·5
49 30	15 00	W.S.W.	79	97	3·0	38·0	0·0
49 30	20 00	W.	195	244	6·0	46·0	0·0
49 30	25 00d	W.	195	228	3·3	54·4	2·2
46 05	30 00	S.W.	290	366	9·0	52·0	1·1
46 05	35 00	W.	208	238	3·4	60·2	1·7
46 05	40 00	W.	208	260	9·1	58 9	1·2
46 05	45 00	W.	208	253	6·0	55·0	1·5
46 05	50 00	W.	208	234	6·0	85·0	0·0
45 00	53 40d	W.S.W.	170	187	0·0	75·0	8·3
44 37	55 00	W.S.W.	61	148	4 7	74·6	0·9
43 08	60 00	W.S.W.	234	255	0·9	73·3	5 3
41 36	65 00d	W.S.W.	239	280	4·2	63·5	4·1
40 02	70 00	W.S.W.	245	266	4·1	64·3	1·4
39 37	71 00	W.S.W.	65	77	5·7	64·7	2·0
40 27	74 00d	W. by N. ½ N.	[illegible]	176	5·5	58·9	3·0
			3086	3742			

April.

Lat.	Lon.	Courses.	Distances. Direct.	Distances. True.	Winds, per cent. Head.	Winds, per cent. Fair.	Winds, per cent. Calms.
49° 30′	5° 00′	to					
49 30*	10 00	W.	195	213	3·5	78 0	5·0
49 30*	15 00d	W.	195	220	1·1	71·7	0·0
50 40	10 00d						
49 30	15 00	W. ½ S.	205	248	7·5	57·2	4·0
46 06	20 00	S.W.	289	317	9·6	49·0	7·5
45 00	21 54	S.W.	93	104	2·5	71·5	5 9
44 46	25 00	W. ½ S.	147	168	0·0	52·4	5·7
45 00	30 00	W. ½ N.	147	171	6·0	73·5	4·5
44 46	35 00	W. ½ S.	147	172	6·7	74·2	1·0
44 46	40 00	W.	215	236	12 4	52·2	2·7
44 46	45 00	W.	215	271	7·1	45·0	2 7
44 46	50 00d	W.	215	255	5 2	62·8	6 9
43 16	55 00	W.S.W.	234	268	8·2	65·7	10 1
41 43	60 00	W.S.W.	242	276	4 1	55·0	4·1
41 43	65 00d	W.	223	272	6·5	54·5	7·5
40 27	70 00	W. ½ S.	240	268	7·3	66·4	2·5
40 27	74 00	W.	182	210	3·6	60·4	7·1
				3439			

According to the pilot-charts, says Lieutenant Maury, I make the average distance to be sailed by a New York packet-ship by these routes, not estimating for the set of currents, to be when bound

To Liverpool.

In January, 3075 miles to 10° W., for 250 of which a vessel will have winds dead ahead.
February, 3015 " " 234 " " " "
March, 3160 " " 231 " " " "
April, 3051 " " 244 " " " "

To the English Channel.

In January, 3300 miles to 5° W., for 293 of which a vessel will have winds dead ahead.
February, 3245 " " 261 " " " "
March, 3448 " " 249 " " " "
April, 3275 " " 265 " " " "

According to the log-books taken at random, both of packet-ships and transient traders, I find the average time between these meridians and New York to be as per statement subjoined.

To or from Liverpool. **To or from the English Channel.**

From New York to 10° W.		From 10° W. to New York.		From New York to 5° W.		From 5° W. to New York.	
Month.	Days' Passage.	Month.	Days' Passage.	Month.	Days' Passage.	Month.	Days' Passage.
January	18	January	33	January	20	January	40
February	20	February	35	February	23	February	41
March	20	March	31	March	25	March	33
April	21	April	29	April	22	April	30

* From the Channel.

Routes from New York to the South Atlantic, Etc.

We have given above the result of Lieutenant Maury's deductions from the wind-chart as to the best routes across the Atlantic; and on these he remarks, at a subsequent date to these promulgations—"In the European voyages I have found not much room for improvement as to routes, except to those shipmasters who are just entering that trade; to them these charts give all the information as to winds, currents, and routes, that is possessed by the oldest and most experienced 'packet captains.' When navigators shall agree to follow these new routes, the average sailing passage between Europe and America will, it is believed, from what has been already done, be considerably shortened.

"But the new routes which these charts have suggested to the Equator, and which lead through parts of the ocean in which the winds and currents were not so well understood as they are along the tracks to Europe, have been attended with more decided advantage, and the most signal success."*

These observations bear out our remarks given on page 208, inasmuch as the track recommended is that of the great circle, joining Cape San Roque in Brazil and New York, cutting the Equator between lon. 29° and 31½° W. Want of space will prevent our giving the tables as detailed in the work in question, but the great circle course, as before stated, holds an intermediate course between those recommended for each month.

"It is well known that the route (from New York) to every port in the Pacific, Indian, and South Atlantic Oceans, is the same as far as the Equator; and indeed until Cape San Roque in Brazil be cleared. These charts have actually shortened the average passage hence to the Equator from two days to two weeks, or more according to the season of the year; this is shown by the results of actual trial. More than a hundred passages have been made by these charts, and according to the routes prescribed. The average length of passage by the old route from the ports of the United States to the line is forty-one days. The following table will show the comparison in the separate months of the new route with the old routes as actually tried.

Month.	New Route.			Old Route.		
	Crossed the Equator.		Passed Cape S. Roque.	Crossed the Equator.		Passed Cape S. Roque.
	Days.	Lon. W.	Days.	Days.	Lon. W.	Days.
January	31·2	28°31′	35·1	31·6	21°23′	36·7
February	25	29 40	28·0	36·6	22 23	41·2
March	27·5		32·8	43·0		46·7
April	28·6		31·8	37·3		40·3
May	34·1		36·7	42·5		45·0
June	33·4	28 50	35·8	41·5	23 44	44·2
July	39·8		42·8	48		51·4
August	41	29 30	43·7	42·6	24 30	45·8
September	39·1	29 00	42·1	42·9	23 50	45·6
October	37·3		40·3	41·3		45·3
November	32·8		37	42·6		45·1
December	33·7		37·6	38·5		42·0

GULF OF ST. LAWRENCE, &c.—Those bound to the Gulf of St. Lawrence, after passing to the southward of the Virgin Rocks, on the Grand Bank, and the Island of St. Pierre, should keep a middle course between Newfoundland and Breton Island; not forgetting what has been heretofore said on the winds and currents (pp. 251 and 252). Recollecting also, that the harbours on the coast, westward of Fortune Bay, are impeded with dangers; there are many rocks about the entrances, and most of the harbours are imperfectly known. The rocks are not to be seen in thick weather, and fogs very much prevail on the coast.

Commanders of vessels bound to the Gulf of St. Lawrence will do well to observe that, off the South coast of Newfoundland, between the meridians of 55° and

* Maury's Sailing Directions, Third Edition, November, 1851, pp. 115, 116.

56°, and the parallels of 45° and 20′ and 46° 15′, is a deep gully in the sea, extending in a true N.N.E. and S.S.W. direction, and separating the Bank of St. Pierre from the Green Bank. *The method adopted by the French vessels bound to St. Pierre for making that island is as follows:—*

From the longitude of 52° W., in lat. 45°, they steer a N.W. course by compass, which carries them across the Green Bank, in 48 fathoms of water; and when on the meridian of 55° 10′, in about 45° 35′ N., they suddenly deepen their water, from 45 to 90 fathoms. A further run on the same course of about 10 miles carries them across this gully, when they shoalen their water again to 35 and 30 fathoms; and, after a further run of 23 miles, they steer about N.N.E. directly for the island, and seldom or never miss it.—(*See the Chart of Newfoundland, &c.*)

Those who have lost their reckonings, on finding this gully, which may be known by the water shoaling on the East and West sides of it, an experiment that is frequently made for ascertaining whether they are actually in it or not,—may safely take it as a *fresh departure.* Commanders, not being aware of it, when they have found their water deepen from the Green Bank to the westward, have imagined themselves entering the Gulf of St. Lawrence; and, by steering a course too far to the *northward,* have been lost to the eastward of Cape Ray, on the rocks of Newfoundland. The length of the gully is about 60 miles, in a true N.N.E. and S.S.W. direction, and the middle of it is in lat. 45° 50′, and lon. 55° 15′.—*Communication of the French Commandant to Captain Sir Richard Grant, R.N.*, 1833. [Corrected.]

The little Island of St. Paul, which lies to the north-eastward of Cape North, now distinguished by its lighthouses, is bold-to, steep, and high; and, with a good look-out in the daytime, cannot be considered as dangerous even in thick weather. The land of Breton Island is very high, and though fogs are about it frequently, it is seldom so much obscured as not to be seen in time. On entering the gulf, the Magdalen and Bird Islands will be seen, as they lie in the direct course from Cape North to the River of St. Lawrence. [See *Notes* 1 and 2, p. 65.]

There is, in clear weather, a safe passage between the Bird Islands and the Magdalens; but, in thick weather, it is advisable to keep either to the southward or northward of both, as the wind may permit.

In Pleasant Bay, on the S.E. side of the Magdalen Islands, there is clear and good anchorage, very near the shore; and it is a very safe place for vessels to ride in, with a westerly wind, and infinitely preferable to beating about in the Gulf with a foul wind. There is a safe passage into it between Amherst Island and Entry Island.

As the weather to the southward of these islands, between them and Prince Edward Island, is generally much clearer than on the North, the passage that way is preferable, particularly after the early part of the year, when S.W. winds mostly prevail.

See, further, our *British American Navigator*, pp. 8—14, and *Colombian Navigator*, vol. i. p. 85, note.

UNITED STATES.—The course of ships bound from Europe to the ports of the United States is controlled, in a great degree, by the operation of the Florida Stream, as we have already shown. Little, therefore, requires to be added to the subject here. Those bound to the northern and middle ports, when passing the shoal grounds on George's Bank, should take care to pass between these shoals and the stream. Also, when passing the Nantucket Shoals, to keep between them and the stream.—(See the *Description of Shoals, &c.*, hereafter.)

By taking this precaution, so as to keep between the stream and shoals, a ship may shorten her passage to New York, Delaware, Virginia, &c.; for she will have, *mostly*, in this track, the advantage of the current running contrary to the stream, which is alluded to on pp. 253 and 254, when the latter would retard her progress at the rate of 60 or 70 miles a day.

Ships crossing the stream, when bound to the westward, must get over as quickly as possible; or, it is clear, that they will be carried far out of their course.

It has been remarked that ships from sea, approaching any part of the American coast between Long Island and Cape Hatteras, if in doubt about their reckoning, should take notice of the gulf-weed, which is in greater plenty, and in larger clusters, to the eastward of the Gulf Stream than in it, where frequently, though not always, the sprigs are but small and few.

The outer edge of the bank off this part of the coast appears to be very steep; for it has been frequently found that, while the lead has been kept going, there have been found 45 fathoms, soon after 35, and a mile nearer shore only 25 or 20 fathoms; from these depths the shoaling to the shore varies in different directions.

The soundings along the New Jersey coast are the most regular, as the water there shoalens from 35 fathoms on the outer edge to 10 or 12 fathoms in sight of land, and thence to 7 fathoms near the shore; excepting only from 2 leagues South of Shrewsbury Inlet to the Bar of Sandy Hook, where the water is deeper. Here are 10 fathoms near the shore, and deeper farther out, with some patches of rocky bottom. In lat. 39° 24′, the outer edge of soundings lies 19 leagues from shore, and E.S.E. from Great Egg Harbour, 18 leagues.

For the WINDS *on the South-eastern Coasts of the United States*, see pages 134, 135.

MONITIONS and INSTRUCTIONS for Vessels navigating on the WESTERN SIDE of the ATLANTIC; by Mr. Redfield, of New York. (*Abstracted from the American Coast Pilot*, 1833.)

1. Between the latitudes of 32° and 45° (the parallels of Georgia and Nova Scotia) a vessel bound to the *eastward*, on being overtaken by a gale which commences blowing from any point to the eastward of S.E., or E.S.E., may avoid some portion of its violence, by putting her head to the northward, and when the gale has veered sufficiently in the same direction, may safely resume her course. But, by standing to the southward, in like circumstances, she will probably fall into the heart of the storm.

2. Within the same region, a vessel, on being taken in a gale from S.E., or points near thereto, will probably soon find itself in the heart of a storm; and, after its first fury is spent, may expect its recurrence from the opposite quarter. The most promising mode of mitigating the effect of its violence, and at the same time shortening its duration, is to stand to the southward upon the wind, so long as may be necessary or possible; and if the movement succeeds, the wind will gradually head you off in the same direction. If it becomes necessary to heave-to, put your head to the southward; and, if the wind does not veer, be prepared for a blast from the north-west.

3. With the wind at East or N.E., a vessel, by *scudding* a gale, shortens its duration. By scudding, on the contrary, before a south-westerly or westerly gale, you will thereby increase its duration.

4. A vessel, on pursuing her way to the westward or south-westward, meets the storms in their course, and thereby shortens the periods of their occurrence; and will encounter more gales in an equal number of days, than if stationary, or sailing in a contrary direction.

5. Vessels, on the other hand, while sailing to the eastward or north-eastward, or, in the course of the storms, will lengthen the periods between their recurrence, and consequently experience them less frequently than vessels sailing on a different course. The difference of exposure, which results from these opposite courses, on the American coast, may, in most cases, be estimated as nearly 2 to 1.

6. The *barometer*, whether in the higher or lower latitudes, always sinks while under the first portion or moiety of the storm on every part of its track, excepting, perhaps, its extreme northern margin, and thus often affords the earliest and surest indication of the approaching tempest. The mercury always rises again during the passage of the last portion of the gale, and commonly attains the maximum of its elevation on the entire departure of the storm.* The indications of the barometer ought not to be neglected, even should the fall of the mercury be unattended by any appearance of violence in the weather, as the other side of the gale will be pretty sure to take effect, and often in a manner so sudden and violent, as to more than compensate for its previous forbearance. The prognostics engraved on the scale are not to be regarded: the mere *rising* and *falling* of the mercury are the particulars to be attended to.

7. The vicissitudes of winds and weather which do not conform to the implied specifications, are more frequent in April, May, and June, than in other months. Easterly or southerly winds, under which the barometer rises, or maintains its elevation, are not of a gyratory or stormy character; but such winds frequently terminate in the falling of the barometer, and the usual phenomena of an easterly storm.

* See upon this subject the Observations upon the Hurricanes, &c., on pp. 136, 137, and the Appendix hereafter.

Steam Navigation across the Atlantic.

The first steam-ship which crossed the Atlantic was the *Savanna*, commanded by Moses Rogers, which was built at New York, in 1818, and which left the port of Savanna on the 25th of May, 1819. She anchored at Liverpool on the 25th of June, left that port for St Petersburg on the 23rd of July, and arrived at Cronstadt, October 6. On the 30th of November she again anchored at Savanna, having on her return voyage stopped four days at Copenhagen and four days at Arendal in Norway. During the whole of this period she met with no accident except the loss of a small boat and anchors.

The *Savanna* sailed to Europe twice, and her captain, Rogers, was complimented with several handsome presents from the Emperor, the Grand Signior, &c.

The celebrated British steamer, for the ports of America, "*The Great Western*," of 1,340 tons, was launched at Bristol, July 19, 1837, and proceeded from that port for New York, under the command of Lieutenant Jas. Hoskins, R.N., on the 8th of April, 1838.* Taking the usual route, she was on the eastern edge of the Newfoundland Bank at noon on the 17th, in lat. 44° 10′, and, proceeding to the S.W., left the southern edge on the 18th, in lat. 42° 58′. Passing northward of the Gulf Stream, she arrived at New York on the 23rd, amid the plaudits of innumerable spectators and every demonstration of joy. The journalist says, that "the moment of her arrival was an exciting moment, which, in the tame events of life, finds few parallels; it seemed to be that of the out-pouring congratulations of a whole people, when swelling hearts were open to receive and to return them. It was a moment that, if both nations could have witnessed it, would have assured them that, at heart, there is still a feeling and an affinity between them. It was a moment of achievement! We had been sharers in the chances of a noble effort, and each one of us felt the pride of participation in the success of it, and this was the crowning instant."

The mean length of the passages made by the steamers across the Atlantic to New York in the year 1840 is, outward, sixteen days; and home, fourteen days twenty-two hours: the mean velocity being, outwards, 8 knots; and homewards, 8·6 knots per hour. But the *Great Western's* passages out averaged fifteen days fourteen hours; and home, thirteen days fifteen hours: the former rate being 8 knots, and the latter 9·6 knots per hour.

In 1840, a line of steam-ships were appointed to carry the mails between Liverpool and Halifax, and the average length of their passages, until 1842, was, out, thirteen days six hours; and home, eleven days five hours: or, at the rate of the first, 7·86 miles; and the latter, influenced by the prevailing wind and current, 9·3 miles. The quickest passage was made by the *Columbia*, homeward, in nine and a half days.

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5. ROUTES TO AND FROM THE SENEGAL AND GAMBIA.†

Whatever may be the season of the year, it is advisable to gain an offing of 25 leagues to the westward of Cape Finisterre; from hence it may be immaterial whether a course be shaped to the eastward or westward of Madeira. A commander desirous of touching at the Canaries will adopt the former, and will shape a course for Tenerife, having nothing to apprehend on this course but the Salvages, the position of which has been well determined. In the Canarian Archipelago the winds are mostly from North to N.E. If the course to the westward of Madeira be adopted, a vessel will make the westernmost of the Canaries only, and her place may be rectified by a sight of Palma or Ferro.

But a sight of the coast of Africa is by no means necessary for vessels bound to the Senegal or Goree. What has been said of the currents and prevailing winds in this navigation, leaves no doubt that it is perfectly useless to make the land more than 15 or 20 leagues to the northward of the Senegal, when bound to the Bar-anchorage. This digression is the utmost which should be made from the above course; and by means of the lead, and some few latitudes carefully observed, it might even be made a direct one.

* The dimensions are given in the *Nautical Magazine* of October, 1837.

† Abridged, chiefly, from the Baron Roussin.

On leaving Tenerife, the course should be S.W. ¾ S. [*S. by W. ½ W.*] as far as the parallel of 21°, then S. by W. ¾ W. [*South*] as far as 20°, and from thence S. by E. ¼ E. [*S.E. by S.*] without any further alteration.

The first course will carry a vessel more than 25 leagues from the nearest point on the African coast, and in a track where no danger has hitherto been found. The second will conduct her 26 leagues to the westward of the westernmost point of the Bank of Arguin. By the third she will make the coast in the neighbourhood of the *Marigot or Lagoon of Mosquitos* (lat. 16° 35½′), from whence she may coast the shore until abreast the Senegal, in 15° 55′ N.

If it be found necessary to make the land during the night, the lead, being the only means of correcting the estimated run, should be used frequently and with great care. At about 10 leagues from the shore to the northward of the Senegal, a bottom of white sand will be found, with 70 fathoms. From thence the depth gradually decreases toward the shore, and at 1 mile from it there are 7 or 8 fathoms. When in 15 fathoms of water, it is advisable to anchor until daylight, to avoid running past the bar, which has no distinguishing mark by night.

There is a source of error attached to the navigation of the African coast which must be carefully guarded against. It is the optical illusion caused by the great horizontal refraction, which renders any correct estimation of distance almost impossible. Numerous instances of it might be cited, which would hardly be credited; therefore the moment the coast is seen, the lead only should be trusted, to determine the distance from it.

TRACK FROM SENEGAL TO GOREE.—The *Almadies* of Cape Verde (described hereafter) are 31 leagues S.W. by W. ¼ W. [*S. 40° W.*] from the roadstead of the Senegal, and the prevailing currents set nearly on that bearing; it is, therefore, the course to be steered from the Senegal to Cape Verde during the day. During the night steer a quarter of a point more westerly. From Cape Verde to Goree the course is direct. It is merely to coast the shore at the distance of 2 miles. From Cape Verde to Cape St. Mary, at the mouth of the Gambia, the direct course and distance are S. by E. ¼ E. [*S.E. by S.*] 30½ leagues, in all which space soundings may be found.

RETURN TO EUROPE.—The voyage from the Senegal to Europe presents no difficulty, and calls for no other precautions than those commonly used in long voyages on seas void of dangers. These precautions are, not to trifle with the wind, but rather to make a good run in a given time, than to endeavour to make good the proposed course. In all return voyages from places within the Tropics, the grand point is to leave the region of the trade-wind, and get into the variables, and the currents setting to the eastward, as soon as possible. As the winds generally blow from East to N.W. on the coast of Africa, from the month of December to the end of June, you should keep on the starboard tack until out of their influence. The course made good will be about N.W., and you will then be in the neighbourhood of the Azores. It is immaterial whether you pass to the northward or through the channels of these islands, but it has been remarked that the winds are strongest on the westward. It is seldom possible to pass to the eastward of them. The distance, no doubt, would be shortened; but this passage can be effected only by keeping close to the wind thus far; and experience has proved that, by such procedure, little is to be gained.

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6. GENERAL INSTRUCTIONS AND ADMONITIONS FOR VESSELS BOUND FROM LIVERPOOL AND OTHER WESTERN PORTS TO THE ATLANTIC OCEAN, AND FOR RETURNING FROM THE OCEAN TO THE SAME; BY CAPTAIN THOMAS MIDGLEY, OF LIVERPOOL, 1839.

"Many shipmasters have been bewildered in St. George's Channel, especially in thick weather, from ignorance of the tides and want of experience; some, we are sorry to add, from want of due consideration, and others from not allowing for the indraught into the bays on the Welsh coast.

"The writer of the following hints and observations begs to be understood as laying no claim to merit in their compilation; his only motive being to assist and advise the *stranger*, and those who, from want of experience, have acquired only a slight knowledge of this dangerous navigation." The instructions are arranged as follow:—

1. On proceeding from Liverpool westward to the Bay of Holyhead.
2. On taking the North Channel, and proceeding thence to Tory Island.
3. On proceeding by the South Channel, and thence westward to the Ocean.
4. On proceeding by the South of Ireland from the Ocean to Liverpool, &c.

(*Throughout the whole of this paper the courses, bearings, and state of the winds, &c., are to be understood as by compass.*)

1. On proceeding from Liverpool westward to Holyhead.

Before proceeding with Captain Midgley's paper, we may notice some important changes which have occurred in the ever-varying sands, which embarrass the approach to the Port of Liverpool. These are shown in a survey made at the end of 1851, and the necessary alterations in the beacons and lights were effected on October 16th, 1851.

The Formby Old Lighthouse has been again illuminated, instead of the Crosby Light-tower, which is now disused. The light is *red* at 95 feet, and visible between S.E. ½ S. and N.E. by E. ¾ E.

The Formby Lightship, the Crosby Lightship, and the Bell Beacon, have been shifted to accord with this new light, and for the service of the New Channel to the N.W., now called the *Zebra Channel.*

At the entrance of the *Victoria Channel* is the Bell Beacon, a float with a self-acting bell, and in line with the Formby Light-vessel and the Old Formby Lighthouse, bearing E. by S. These are figured and described in the *Directory for the St. George's Channel, &c.* (pp. 84, 85.) The Victoria Bell Beacon is sometimes capsized or sunk, and therefore it should be approached with caution, as any mistake may be fatal; and it should be carefully impressed upon the minds of *all*, that a ship should not be run to the eastward of the Ormes Head without a pilot.

Within the Channel to the Mersey is the Crosby Light-vessel, painted *red*, with a large *red* ball by day; she has only *one* mast, and shows *one* bright light, and must not be mistaken for the Formby Float with two masts and lights: there is a good channel on either side of the Crosby Light-vessel, but it is widest to the eastward.

The *Zebra Channel* runs between the Little Burbo Bank and the Taylor Flats. Its entrance is marked by a black and white vertical nun buoy, and the course through it is with this buoy and the Formby and Crosby Lightships in one, bearing S.E. by S., and the least depth in it is from 9 to 12 feet at lowest springs.

The Black Rock Lighthouse, at the entrance of the Mersey, on the West, has revolving lights, two brilliant and two red, at intervals of a minute. Westward of this, on the Cheshire coast, stand the *Leasowe* or *Lizza Lights;* within which is the lighthouse on *Bidston Hill*, and farther West the *Hoylake Lights* on the shore near Helbre Point.

The Lightship in the centre of Liverpool Bay is eminently useful as a guide to the different channels. It shows three bright lights; its figure, with those of many other marks, is given in the *New Directory for St. George's Channel, &c.;* but, in lieu of a flag, a large black ball is now hoisted at the mainmast head.*

Next to the Pile Lighthouse, off the *Point of Ayr*, the N.W. point of the mouth of the Dee, which shows a red light within the Hoyle Sand, and bright when in the Channels, at the distance of 25 miles, is the *Menai Tower*, upon *Twyndu* or *Black Point*, on the West side of the entrance of Beaumaris Bay, with a fixed *red* light. Then follows the

* The vessel lies in 7 fathoms at low water, and from being the outer beacon object of the port, is called the *North-West Lightship;* the hull is bluff-built, with a short bowsprit, and painted black. The lights are from lanterns fitted around the masts, with eight lamps and reflectors in each, appearing in the order of fore, main, and mizen tops, elevated respectively at 32, 40, and 26 feet above the water line, so that they cannot blend as one light, unless at a considerable distance or in hazy weather; to prevent this, a blue light, of three minutes' duration, is burnt on board every two hours of darkness, according to the seasons; November to February inclusive, commencing at 6 p.m.; March to October, at 8; May to August, at 10. The blue lights, being elevated on a pole, can be seen in the horizon so soon as the mizen lantern rises to view, which is at 10 miles' distance. During a fog a bell is rung and a gong sounded alternately; and to give a chance of being "peered-out" *under* a dense haze, the mizen lantern is lowered under the gunwale.—*Captain Denham*, 1840.

flashing or intermitting light on *Lynas Point*, which is seen between 6 and 7 leagues off. The next remarkable light is that of the *Skerries*, near Anglesea, with its fixed light; and the last is the revolving light on the South Stack, near Holyhead. All of which have been described.

Point Lynas (Elianas?) the N.E promontory of Anglesea, is the western station of the Liverpool pilots. Its lighthouse and telegraph, supported by the Dock-trust of Liverpool, is, says Captain Denham, the accustomed finger-post, or positive point of departure, properly sought for by the mariner seeking a pilot for Liverpool, &c.

A.—*The Lantern.*

Appearance of Point Lynas and Lighthouse, when nearing it from the Westward.—(Captain Denham.)

It has been observed, by *Lieutenant Thos. Evans, R.N.*, a gentleman intimately acquainted with this coast, that near Point Lynas there is neither anchorage nor shelter when the wind blows from the N.W., and then it is with difficulty that the pilot keeps his station, especially in long winter nights; and even when the wind blows from the southward, vessels bound up for Liverpool often round the Skerries too suddenly, and are carried on the *Coal Rock*, where they perish and are never more heard of: whereas others, more apprehensive of the danger, keep *too great an offing*, and thereby miss the pilot, notwithstanding the vigilance of the latter.—*Piloting Directory for St. George's Channel, &c.*, page 52.

We now revert to Captain Midgley's Instructions:—

Liverpool being the principal and central port in St. George's Channel, and the prevalent winds being from the westward, W.S.W., and S.W., during eight or nine months of the year, I shall suppose that a large ship leaves that port, with an adverse wind, from the westward. Having discharged the pilot off the lightship, stand to the northward all the ebb tide (which, in Liverpool Bay, sets to the N.W., and the flood to the S.E.), and, if laying N N.W., or to the westward of this direction, during the first quarter of the flood, keep the lead occasionally going, with a careful look-out for the Isle of Man, which is moderately high, and on the South side bold-to.

Should there be a strong breeze, and a heavy sea, the vessel may not weather the West Hoyle Sands, on the starboard tack; and great caution is, therefore, required when going near them, as they are bold-to and very dangerous. In thick weather the lead must be constantly used, and the sands should not be approached nearer than in 10 fathoms of water.

The soundings along the North coast of Wales, eastward of Point Lynas, will pretty accurately determine the distance of the ship from the land, provided due attention be paid to the *depth* of water; but the *quality* of the soundings will not indicate the particular part of the coast she may be abreast of.

The "*Ormes Heads*" are very bold, and any vessel may safely steer a direct course from thence to Point Lynas, which may be known by the castellated building near its extremity, used as a lighthouse, and its telegraph station upon the summit.

Point Lynas and the land to the westward of it is very bold, but the ebb tide hence runs very strongly to the W.N.W. and through the Sound inside the Skerries. Off the Middle and West Mouse the spring ebbs run at the rate of 7 knots; and all vessels

should, consequently, give this part of the land a good berth, during light winds, at such times as the flood or ebb may be running strong; or they may, upon an ebb-tide, get into the vicinity, or perhaps upon, the Coal Rock or the Skerries Platters.

The Coal Rock bears E. ½ S. 2½ miles from the Skerries, and lies with the West Mouse (a large rock always high above water) on with the two beacons on Carnel Point. The Platters are nearly the whole length of the Skerries Rocks, and lie at about one-third of the distance between the Skerries and Carnel Point.

Beaumaris is a good harbour for all ships, into which a Liverpool pilot will conduct them, provided no licensed pilot for the port may be found; but the Beaumaris pilot-boat is generally cruising off the chops of the bay, between the Ormes Heads and Lynas, or lying at anchor within it.

Holyhead is also an excellent harbour; large ships must lie aground, in about 14 feet at low water, but they will be quite as safe and as free from damage as in the Liverpool Docks. Great caution and good management are required, however, in entering this harbour, which must not be attempted without a pilot, if one can possibly be procured.

On coming round, by the South Stack or the Skerries, into the chops of Holyhead Bay, make known your intention of coming into the harbour by making the usual signal for a pilot, and one will come off in a row-boat. This harbour must not be taken before half-flood, and no vessel should attempt it at night if they can possibly keep off shore until daylight, unless very well acquainted.

2. On taking the North Channel, and proceeding thence to Tory Island.

If, after weathering the Hoyle Sands, the wind should be so far to the southward of West as to enable a vessel to weather the Isle of Man, it may be a matter of consideration whether it be most advisable to go through the North or the South Channel; but this should not be hastily decided on. In the summer months the winds are more variable than in winter, and then it is certainly advisable to choose that passage which is nearest to the destined port; giving the preference to the North Channel if bound to British America, Newfoundland, or the northern ports of the United States. In winter, the prevalent winds are from S.W. and W.S.W., and these winds often blow steady for several days.

Should the North Channel be preferred, with southerly and S.S.W. to W.S.W. winds (and it should not be attempted with any others that have westing in them, especially by a stranger), it is advisable to take a departure from the lights on the Calf of Man, and steer a direct midchannel course, with a careful look-out, as the passage is narrow and the tides very rapid, but running directly through the Channel: the flood setting from the northward toward the Mull of Galloway. With a W.S.W. wind it will be necessary to keep the Irish shore aboard, after passing the two lights on the Maiden Rocks; or it is possible, in a strong gale from this quarter, that there may be some difficulty in weathering the Isle of Ila.

The North Channel is well lighted, and has many excellent harbours, fit for the largest ships, as Lough Foyle, Belfast Lough, Loch Ryan, Campbelton, Lamlash, &c.; but it is advisable for vessels, if possible, to take those upon the Irish coast, as they can get to sea with southerly and S.W. winds, when it may be difficult to get away from either Lamlash or Campbelton.

After passing Tory Island, do not be too anxious to make southing, but steer well to the westward, if possible; for there is always a very heavy sea and a strong indraught upon the West coast of Ireland, and strong westerly and W.N.W. gales are very prevalent in the winter. Although there are some excellent harbours in the N.W. of Ireland, they may be considered as inaccessible to a stranger, owing to the great difficulty of procuring a pilot in the winter season; every exertion should, therefore, be made to keep off this dangerous and too often fatal coast.

The depth of water, or quality of the soundings in the North Channel, will give little or no indication of the progress of the vessel, so that a good look-out is here the mariner's best safeguard; the coasts on both sides being bold, excepting about the South Rock and Maiden Rock, both of which dangers are well lighted, but require a good berth in passing, particularly the latter.

In running through the North Channel with S.W. winds, every stitch of canvas should be carried that the vessel will possibly bear, as these winds often fly suddenly round to

the N.W. quarter; and in that case blow so hard, for twenty-four or thirty-six hours, as to compel a vessel either to bear up for the South Channel, take a harbour, or lie-to in a narrow and dangerous channel for a more favourable wind.

3. On proceeding by the South Channel, and thence westward to the Ocean.

If it be intended to persevere in working down the South Channel, it will be the best way to keep the Irish shore aboard by short tacks, should the weather be squally with heavy rain, as the vessel will then have the benefit of the N.W. wind and smoother water, should it fly round to that quarter, as is often the case. In dry or moderate weather there is little fear of a sudden shift of wind; and a vessel, in such case, may make a long board toward the coast of Wales. Should it come on to blow from the S.W., with much rain, get the Irish coast on board as soon as possible, especially in the winter.

Vessels passing up or down the South Channel with westerly winds will find a strong indraught setting into Caernarvon and Cardigan Bays, as well as into the Bristol Channel; and this may be probably, in some degree, accounted for by the following, and, perhaps, other causes:—Southerly, S.W., and westerly winds prevail over the Atlantic, between the Azores and Great Britain, during eight or nine months of the year, causing the surface-current in this vast space to flow to the eastward; the tides in the neighbourhood of and to some distance westward of Scilly run nine hours out of the twelve to the northward, or into St. George's Channel, which, like the Strait of Gibraltar, has some resemblance in form to the pipe of a funnel; and it is probable that, in gales of wind from the S.W. quarter, there is very little, if any, ebb from the western edge of Channel soundings to a position 15 leagues West from Scilly, and thence to the northward, on the same meridian, until within 15 leagues of the South coast of Ireland: neither do I think it at all unlikely that a portion of the stream of "Rennell's Current," which frequently, as I shall hereafter show, runs with velocity to the N.W., may be diverted by westerly gales into a more northerly direction, and being opposed in its course by the South coast of Ireland, finds its way to the eastward, and thus contributes to raise the level of the water, and make a strong tide or indraught into St. George's Channel.

This stream of tide sets E.N.E. toward the Tuskar, and nearly in the same direction, or a little more northerly, toward the Smalls, and rushes, with great velocity, past Skokham and Skomar, through the sound, towards St. David's Head, and along the South and East coasts of Cardigan Bay, from whence it diverges toward Bardsey Island; in the sound between which island and the main it runs with great strength.

It has been before stated, that it is generally advisable to keep the Irish shore aboard in turning down St. George's Channel, with S.W. winds and heavy rain. In the South Channel the lead will impart some idea of the position of the vessel, or, at any rate, will indicate, by the depth of water, the probable distance of the vessel from the land. The banks on the Irish coast, between Howth Head and the Arklow Bank, may be safely approached to 20 fathoms of water, and nearer should it be clear weather, which, by-the-bye, is not often the case in this neighbourhood. When near the N.E. end of the Arklow Bank, and from thence to the westward, no vessel should shoalen her water under 28 fathoms, without daylight and constant caution. The tides of both flood and ebb run directly over these banks, in a N.N.E. and S.S.W. direction, and in light winds must be carefully attended to.

In beating to the westward, should a vessel shoalen her water on the coast of Wales to 30 fathoms, she will be quite far enough in-shore, and should tack immediately, for it should be recollected that there are 36 and 40 fathoms very close to Bardsey.

Should a vessel be caught with hard N.W. gales upon this dangerous coast, every exertion must be used, by carrying taut well-set sail, to get the ship round the Bardsey, when she will have St. Tudwal's Road (which is well sheltered with westerly winds) under her lee, but a pilot can seldom be obtained here. The fixed light of Bardsey is open to seaward only when it bears from N.E. ¼ E. to E. ½ S. Should N.W. winds continue blowing hard, it will be better to run for St. Tudwal's Road, on the North, or to Fisgard Bay, on the South, than to persevere too long in attempting to work out of Cardigan Bay.

Any moderate-sized vessel may find good and safe anchorage in Fisgard Bay, by running in to 2 or 3 cables' length from the *Cow Rock*, on the West side of the entrance,

and anchor when the land to the westward of it is shut in, and the rock bears N. by E., distant 4 cables' length. At this anchorage there is full 5 fathoms at low water, over a bottom of stiff clay and mud, which holds remarkably well, and the ship will lie well sheltered with all winds, except those from the North round by the eastward to S.E. by E. or S.S.E. N.E. winds throw in a heavy sea.

The coast in the vicinity of Fisgard Bay is clean and bold, and the bay may be readily distinguished from the offing by the Cow Rock, which is always above water off the western point of the entrance, and by the remarkable appearance of Dinas Head (the eastern point), which, upon an easterly or S.E. bearing, exactly resembles the head of a large gurnet.

Were the advantages of Fisgard Bay more fully known, they would be duly appreciated. When the writer commanded the brig *Freeland*, of Liverpool, that vessel was disabled, by the loss of her sails, in the heavy N.W. gales which prevailed in December, 1833, and was obliged to run into this bay in order to save the vessel from a lee shore; and in this place she lay in safety, at single anchor, with 70 fathoms of chain, during the tremendous gales that caused the Liverpool Lightship to part her moorings, and compelled her to run into the Mersey for shelter.

From what has been stated above, it will be seen that this bay is of easy access and egress, but it should never be used unless in a case of necessity, and then with a good and careful look-out at all times, and everything should be in readiness to trip the anchor at the moment the wind veers to the eastward of North, if the weather be not very moderate and settled.

On weathering the Smalls, when outward-bound, it is advisable to keep well to the westward if the wind will permit, so as, on advancing southward, to give Scilly a large berth—say of 18 or 20 leagues.

4. On proceeding by the South of Ireland, from the Ocean to Liverpool, etc.

In coming from the westward, many navigators endeavour to make Cape Clear, as it is high land, and has an excellent revolving light. The coast in the neighbourhood is also generally bold. But I do not think this is an advisable plan for a stranger, unless he has obtained good observations a very short time previously; for I have known vessels to be detained several days in endeavouring to work round the cape against strong southerly gales and a N.W. current—unquestionably "*Rennell's*."

In two of these cases, one in 1836, and the other in 1839, two different shipmasters ran with confidence for Cape Clear, upon the faith of good observations for latitude, taken forty-eight hours previously, and both made the *Skelligs* on the starboard bow, when steering E. by S., with the wind from the southward and S.S.W., thick weather and rain. When the Skelligs were near, one of these gentlemen considered his vessel to be on the parallel of the cape, and the other (in 1839) thought that he was at least 10 to 15 miles to the southward of it. It may be proper, however, to add that the latter denied the existence of Rennell's Current, until he thus found the effect of it.

In thick, hazy weather, it may be well to run upon the parallel of 51° N., until the vessel gets into 65 fathoms or less water; then steer E. by N. or E.N.E., keeping the lead occasionally going, and be careful not to advance into less than 40 fathoms, when a channel course of E. by S. may be shaped, having constant recourse to the deep-sea lead. By proceeding in this manner, it is probable that the land will be made in the vicinity of Waterford, or about the Saltee Islands. Waterford may be known by its lighthouse on the Hook Point, on the East side of the entrance of the harbour.

A little to the westward of Waterford are the THREE towers, on Great Newton Head, and TWO towers, upon Brownston Head, as described in the *Sailing Directory*. The latter are about 6 miles to the westward of the Hook Point of Waterford, and are too remarkable to be mistaken. The Saltee Islets are 4½ leagues to the eastward of the Hook Point, known by its tower and fixed light. The *Great Saltee* is high, and may be readily known by the Coningbeg Lightship, moored to the S.W. of it. No vessel should attempt to pass between the light-vessel and the land if it can possibly be avoided, the passage between being rocky and dangerous.

The weather is often very thick on the Nymph Bank, with wind from the southward

and N.W. quarter, and the Tuskar is, consequently, very difficult to make. The Smalls and Tuskar, on the opposite sides of the Channel, when seen in this thick weather, have often been mistaken for a large sloop with a peaked gaff-topsail set. No vessel should run with confidence up St. George's Channel without previously seeing one or other of the lighthouses on these rocks, or the land in the vicinity, as the tides are hereabout very strong, and hidden dangers abound in the vicinity of both places, as shown by the charts. To the eastward of the Nymph Bank the weather generally becomes a little clearer than upon it.

The course may be safely altered when the Tuskar bears North, and an allowance of one point or more must be made for the direction of the wind; particularly if blowing from the N.W. quarter, as this wind not only increases the indraught into Cardigan and Caernarvon Bays, but it throws a heavy sea upon the whole line of the coast of Wales northward of St. David's Head.

In running from the "*Smalls*" toward Holyhead, it is, at all times, advisable to steer a point or more to the *northward* of the direct course, unless there is easting in the wind; and should Holyhead or the South Stack Lighthouse be made upon a bearing to the *northward* of N.E. by E. ½ E., the course should be altered a little, to bring it upon this bearing, otherwise the vessel may find some difficulty in weathering it upon an ebb-tide, if the wind should come out from the N.W. quarter, as there is a strong set (along the land) to the southward into Caernarvon Bay.

The island or rock called the "*South Stack*," distinguished by its lighthouse, is very bold, but, with light winds and a flood tide, strangers should give it a berth of 3 or 4 miles, as there is much danger of being set inside the Skerries, if this is not attended to. In light winds and a flood tide steer well to the northward, until the Skerries bear E. by N., then gradually edge away to the eastward, until the lighthouse bears E. by S., distant 2 miles, when the flood tide, with a very little assistance from the wind, will carry a vessel safely to the northward of it.

The Skerries may be approached by a stranger, on the North side, within a mile; and when the lighthouse bears S. by W., steer E. by N. 2 miles, and East 1 mile, or until the upper beacon on Carnel Point comes open to the eastward of the lower one, when the vessel will be clear to the eastward of the Coal Rock. On proceeding thence with a southerly wind, give a small berth to the "*Middle Mouse*," a large rock always above water, and very bold. On steering thence toward Point Lynas, take particular care not to shut up the light if it be in the night. Should the light happen to be shut up, instantly run to the northward or N.N.E. until it opens, and heave-to or stand off and on for a pilot, about 4 or 5 miles to the eastward of the light, or between it and the Great Ormes Head.

In thick weather, after passing the Skerries, great caution is requisite in order to avoid the Coal Rock, and keep clear of the ebb tide running through the Sound; for, upon an ebb tide, the land between Point Lynas and the Skerries must not be approached within 3 or 4 miles without a commanding and favourable breeze.

Vessels bound to Liverpool should make signal for a pilot immediately after passing the Skerries, as the pilots are very often well to the westward, and keep a diligent look-out; but should no boat be seen, cruise about for one, in the position before stated (between Lynas and the Ormes Head), as the tides here do not run strong; but do not, on any account, run a single mile to the eastward of the Great Ormes Head; for, should thick weather come on, the vessel will be in danger of being driven upon the West Hoyle or the Burbo Banks, and lost. It sometimes, but rarely, happens, when an unusual number of vessels come up on one tide, that there is no pilot-boat on the Lynas station, but it will only be left for a few hours, and vessels should wait with patience, for *here* a pilot is *sure* to be obtained.

The Liverpool pilot-boats are sloop-rigged, with a square-headed gaff-topsail, painted with a white bottom and black bulwarks, and have their number conspicuously painted on the foresail and mainsail. These boats have no topmast, but when upon their station carry a flag at the mast-head. If in the night fire guns occasionally, hoist a light, and show a torch composed of new rope-yarns, unlaid and saturated with bright varnish, then marled slack upon a stick. This shows an excellent light, which may be seen at a great distance; it is also much better and more noticed than a blue light, from the latter being so frequently used as a signal of recognition by passing steam-boats.

The Liverpool pilots are under very excellent regulations, are exceedingly skilful in their profession, and in point of character and conduct are not surpassed by any similar body of men on the coast of Great Britain.

Although I have before noticed the necessity of an unremitting attention to the lead in thick weather, perhaps I may be excused for adding here, that such attention is of the *greatest importance;* as, owing to the velocity of the tides, it affords the mariner the only certain indication of his safety or danger, and contributes to relieve his mind in some degree from the anxiety he must feel whilst his vessel continues within the limits of this dangerous navigation.

It may be well to notice, that, on and after the 1st of December, 1839, Marryat's Code of Signals will be in general use on the telegraph stations between Liverpool and Holyhead.

In *all* the channels leading INTO Liverpool, *red* buoys are to be kept on the *starboard*, and *black* buoys on the *larboard*, hand in going *into* the port; and *all* vessels must keep *inside* or *between* the buoys. In the *Victoria Channel all* the buoys are moored upon the edges of the various banks, which are all bold-to; and there is a black buoy moored opposite, and marked similar to every red one.

Of the four channels into Liverpool, the Victoria is the only one that can, at present, be recommended without a pilot. A vessel cannot lead up this channel with a wind to the southward of S.W., but with southerly winds a vessel can keep an offing.*

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7. General Notes on the Approaches to the Channels and for Navigating the British Channel, by Captain Richard Leighton.

The Bristol Channel I consider safer to approach than either the British or St. George's Channels. The parallel of Trevose Head, on which stand the two lighthouses, has been generally recommended, and that on the parallel of Lundy Island may be used according to circumstances, direction of the wind, &c. In thick or dark weather the soundings will indicate when you have passed a line cutting Scilly and St. Ann's Lights near Milford Haven, and also on nearing the shores on either side. The South side of Lundy is preferred, as you can go safely close round it, taking care to keep the light in sight above the land; and as there are generally pilots lying under the island, you are sure not to miss them by pursuing this route.

For approaching and proceeding up the British Channel, various directions have been given. 1st. *Soundings.* The great difficulty is that the soundings are very deep, and the same water may be got in different positions, both in latitude and longitude, so that a false position by dead-reckoning in the longitude, or in the latitude by the want of observations, is almost as likely to be confirmed as detected; I mean, by *detached casts of the lead.* As a precaution against this I would advise ships (particularly those navigating by dead-reckoning) to "seek the ground early," so that by striking the edge of the bank they may obtain, as it were, a departure, and then take frequent casts of the lead, and make with them a table in the following form, noting the true course and distance between each two casts, and carefully observing the quality of the ground, as well as the depth of the water:—

True Course.	Distance.	Depth.	Quality of the Ground.

And where a few of these are obtained and set off upon the chart, one will check the other. Ships, as well as steamers, have been lost by "*not stopping to sound.*"

The prevalent winds are considered to be S.W. and westerly from May to December, both inclusive, and from January to April, both inclusive; although long and heavy S.W. and westerly gales may occur at this season, yet they are more frequently interrupted by northerly and N.E. winds, particularly in February and March. N.W. winds are considered to be generally of short duration.

To approach and pass Scilly, the parallel of 49° 15′ to 49° 25′ has generally been recommended; in place of which I would recommend (the reasons for which will be

* The alterations in the marks for, and the channels to, Liverpool, since the year 1838, have been introduced into the charts. There are very considerable changes in the form of the banks and depths of the channels, as shown by the survey of 1852. These changes, from the nature of the sands, are continually in operation, and are duly noticed.

given presently), that from 49° 30′ to 49° 40′, according to the wind, &c., as likely to be attended with greater safety; and if Scilly be not made, having taken every precaution to ascertain the longitude, once that its meridian is past, strike for the Lizard, and, if possible, make it, and thence proceed by the rules of the best coasters. Lights can be seen when celestial observations cannot be made; and as the navigation is generally free from outlying dangers, courses should be shaped from one prominent point or light to the next, keeping at a moderate distance to ensure seeing them, if possible. The ships generally met with in this route are coasters, and they keep a good look-out, and are generally very anxious to get out of the way of large foreign-going ships.

Winds, Roadsteads, &c.—With the winds *broad* easterly or westerly, ships may stop on either side of Dungeness, in East and West Bay, and also on either side of Beachy Head, in Seaford Road, westward and eastward of the shoals on the other side, and near Bexhill; and, with westerly winds, the Park, inside of the Owers light-vessel, is also used. Within the Isle of Wight we have anchorage sheltered from all winds. Westward of the Wight, Studland Bay (near Poole) affords good shelter with westerly gales. Portland Road affords good anchorage with the winds to the westward of South; and of a still better kind are Torbay, Plymouth Sound, and Falmouth.

Easterly Winds in the Winter and Spring Months.—Those winds are very destructive upon the East coast, and often cause heavy losses, and great detention amongst the shipping, of which the winter of 1849-50 was an example; and, although those winds may blow long and steady in all the channel, yet at times they do not extend to the westward of Cork, but more generally about the edge of soundings; I have known them to blow long and remarkably steady in the Bristol Channel, and yet ships were arriving at Cork with heavy *S.W. winds*. There is also a kind of periodical occurrence of easterly winds upon the coasts of the United States of America, which have been described by Mr. W. C. Redfield, and he considers them as distinct from the revolving theory of the winds.

Whilst speaking of soundings and channel navigation, I want to strongly urge the use of Captain Sumners's method, as by it a single altitude, giving the line A A with a cast of the lead, or a bearing of the land, will often fix a ship's position with certainty, and its many uses and advantages will soon suggest themselves after a little practice; either at double altitudes, or in connexion with the chronometer, I have found it the best and most correct method yet extant.

My reasons for dissenting from choosing the parallel of 49° 15′ to 49° 25′ to approach the Channel, are—

1st. A ship in this parallel will pass from 30 to 40 miles to the southward of Scilly, and will not expect to see it. I think this precaution attaches too much importance to Major Rennell's thwart channel current, which I do not consider to be a definite current, but only at times occasioned by a combination of circumstances, driving a great excess of water into the Bay of Biscay, and the excess of *tide* to the northward does not require so great an allowance.

2nd. That parallel is the centre of the dangerous group of Guernsey, Jersey, the Caskets, &c., which, I believe, have caused more wrecks to ships bound up the British Channel than getting to the "*northward of Scilly*" has done, and the channel course trends to the northward, the difference of longitude between Scilly and the Caskets may appear great, but great errors occur in dead reckoning, and a ship goes far in a winter night and a westerly gale, but allowing them to avoid those dangers.

3rd. That parallel has led to or encouraged the imprudent and dangerous practice of galloping up in mid-channel, with neither anchor nor cable clear, and trusting to celestial observations and chronometers, as though it were in the middle of the Atlantic; and here we have the *Conqueror*, *Reliance*, &c., sad examples of the effects of not making and keeping hold of the English coast, lights, &c. A great deal was said and written about those cases, but I consider that the amount of error in the course and distance from a position off Scilly or the Lizard, to place a ship on shore between Boulogne and Calais, instead of being in a position off Dungeness, to be an *every-day occurrence* in navigating such a distance in tideways and blowing weather without any check to correct the account, and neither "storm-waves" nor "storm-currents" were required to cause them.

4th. Foreign-going masters generally keep at too great a distance from the land, by

which they not only frequently miss a sight of lights, &c., which it is important that they should see, but they lose the benefit of some degree of familiarity with the land, objects, &c., which a nearer approach would give them, and which in the want of having to go into roadsteads, &c., would be found of very great service.

5th. It is not by keeping near the land that ships get embayed and lost. If it were, colliers would never be safe; they are as much afraid of getting off the land as foreign-going masters generally are of coming near it. The general rule in coasting is to see every guide as you pass it (unless thick weather should prevent it, and in that case strict attention to the lead until you find the next); this rule and attention to the set and duration of the tides are the grand points in coasting.

SECTION III.

PARTICULAR DESCRIPTIONS OF THE COASTS OF THE ATLANTIC; WITH DIRECTIONS FOR SAILING AMONG THE ATLANTIC ISLES.

*** The BEARINGS and COURSES are those by COMPASS, unless where otherwise expressed: but those given thus [*W.S.W.*] signify the TRUE: and the given direction of Wind, Tide, and Current, is to be considered as the TRUE.

1. ENGLAND, FRANCE, SPAIN, AND PORTUGAL.

The Coasts of England and France have been accurately and minutely described in the *New Sailing Directory for the English Channel, &c.* It is not requisite, therefore, nor consistent with the limits of the present work, to repeat the descriptions given therein. But, as it is possible that a ship may be driven, by stress of weather, into the Bay of Biscay, we shall here introduce a few remarks on such of its harbours, or places of shelter, as may be resorted to in case of emergency.

Of these harbours, the first, and probably the best, is that called DOVARNENEZ BAY, to the southward of Brest Harbour. This bay is, in general, fair and clean, and its soundings are so even and regular, that no leading-mark is required. The upper part shoalens regularly to 8 and 6 fathoms, within half a mile of the beach, with fine oozy sand. A large fleet may lie here with as much safety as in Portsmouth Harbour, being almost land-locked to such distance from shore, that no shells can reach.

It is also to be observed, that a strong wind, which may detain shipping here, would also keep in all the Brest fleet; and, with westerly winds, ships can turn out from this bay when none can move from Brest Harbour; so that it has been a useful place for British ships of force, even during war.

A rock, called the *Basse Vieille*, uncovered at two-thirds ebb, lies at the distance of half a league W.S.W. [*S.W.* ¾ *S.*] from Point Chévre, the North point of the entrance; and there are several sunken rocks off the South shore without the bay; but between is a clear channel, 2¼ miles broad. In going in, you sail to the southward of the Basse Vieille, at about 2 miles from the South shore, and will thus have regular soundings, from 35 fathoms, rocky bottom, to 26, 24, and 22, fine sand, all the way till within the bay; thence there are regular soundings to 10, 8, and 6 fathoms. The bottom on the North side is mostly fine sand, as is that in the upper part of the bay, but the former is best for anchorage.

A clump of trees, with a little chapel in the midst, stand on the North side to the eastward of Point Chévre, having a windmill to the westward, and two to the eastward. With the windmill next to the eastward of these trees just open with Chévre Point, you

will have passed the Basse Vieille, and may steer for what part of the bay you please; all being fair and clear, excepting what may be seen above water, and what may be near the shore. The general depths of the bay are from 18 to 12 fathoms; and all, as before observed, is clean ground.

LIGHTHOUSES, &c.—The grand scheme of improvement, in illuminating the French coasts, which has long been in a state of progression, appears now to be, if not entirely, very nearly accomplished, under the guidance of men of the first rank in talent and ability. The lights of Ushant and other lighthouses have been improved, and new towers of the several classes have been established, as shown in our preceding pages.

Of the new lights, those of the *Sein*, or *Saintes*, and *Bec du Raz* must be eminently serviceable to ships advancing from the westward, to the northern part of the bay, while that of Belle-Isle and others are equally serviceable more to the South.*

Even on the Spanish shore, the new tower upon the eastern side of *San Sebastian*, and that on *Cape Mayor*, near Santander, and that on *Cape Estaca*, near Cape Ortegal, are highly important to vessels which may be driven, by stress of weather, toward this dangerous coast, as well as to the pilots.

BELLE-ISLE.—This island, which is high, and seen from a great distance, may afford good shelter in a westerly gale. Its N.W. end is in lat. 47° 23′, and its S.E. point in lat. 47° 16′. The N.W. end of the island is surrounded with rocks; and nearly in a line between it and the Isle of Groix, lies the rocky bank called the *Birvideaux*. If a ship, with the wind at N.W. or W.N.W., keeps between the latitudes above mentioned, when running for the island, on approaching it, she may steer along the South side, at the distance of 2 miles, to Point du Canon, the S.E. extremity. From off this point, haul up for Point Locmaria, the eastern point, which is situate about a league from the former. Under this point may be found anchorage in from 15 to 8 fathoms, sheltered from N.W. and westerly winds. Should the wind here veer to S.W., a ship may run to the northward of the point, and anchor on the N.E. side of the island.

The *Isle of Hœdic* (having a fixed light), which lies about 7½ miles East [*E.N.E.*] from the East end of Belle-Isle, has many rocks, with foul ground about them. The range, called the *Cardinals*, extends to the S.E. from the island, and the extremity bears E.S.E. ¾ E. 12 miles from the S.E. end of Belle-Isle. Should a ship be driven to the eastward of Belle-Isle, she must give the Cardinals a good berth; then haul up to the northward for anchorage.

In the Bay of Quiberon, after you have brought the Cardinals to bear S.S.W., S. by W., or South, there is good anchoring, with clear, soft, clay ground, and very even soundings, in from 10 to 12 fathoms. With these bearings you will be shut within some foul ground, lying off to the Cardinals, in an extent of 3 miles in length, with the Cardinals from W. by S. to S.W., and which has destroyed the cables of several ships of war.

Excellent water may be obtained from the wells at the Isle of Hœdic, with numerous refreshments; the inhabitants being extremely inoffensive, civil, and obliging. Shingle ballast and fine sand are also to be procured in abundance.

ROAD OF BASQUE.—This road lies within the Isles of Ré and Oleron, the north-western extremities of which are distinguished by the lighthouses mentioned in page 23. In running for this place, the rocky banks, called the *Banches Vertes* and *Roche Bonne*, must be carefully avoided.†

The *Isle of Ré*, on its western side, is environed by shoals. Off its N.W. end are dangerous rocks, called the *Baleines*, or *Whales;* and a rocky bank extends thence a league

* The particular descriptions are given in our *Sailing Directory for the Bay of Biscay*, 4th edition, 1845.

† The *Roche Bonne* is a dangerous shoal; being a great flat of rock, lying between the parallels of 46° 10′ and 46° 15′, at 12 leagues westward from the lighthouse on Baleine Point. The S.E. rock, of 18 feet water, lies in lat. 46° 11′ 25″, lon. 2° 25′. The plateau or flat extends N.W. ½ W. to lat. 46° 15′, with a breadth of 2 to 3 miles. Not only on this flat is the swell of the sea to be apprehended, but also on several heads of rock, on which there may not be more than 10 feet at low water. The rocky bottom, situate to the N.N.W. of the Roche Bonne, known under the name of *Banche Verte*, is not dangerous. Westward of the rocks, in all their extent, the bottom is of mud.—*Directory for the Bay of Biscay*, p. 24.

out to sea. The rocks on the S.W. side extend to the distance of half a league from shore; but they diminish thence to the S.E. end of the island.

Off the S.E. end of Ré, midway between it and the main land, is a small rocky bank called the *Lavardin*, dry at low water, spring tide. It lies about 1¼ miles S.E. by E. [*E. by S.*] from the S.E. end of the island, and is now distinguished by a beacon-tower.

Around the North end of Oleron is a shelf of rocks, called the *Antioche Rocks*, which extend 2 miles to the eastward of the lighthouse, but within which there is anchorage. On the light-tower, called the *Tour de Chassiron*, is the fixed light, 164 feet above the sea.

On sailing in, it is safest to keep over toward the Isle of Ré, until near the S.E. end of this island; only taking care to avoid the Lavardin, above mentioned. Then steer for the West part of the Isle of Aix, a flat island, with some houses on it, which lies about half way between Oleron and the main land. The road extends from the Lavardin Shoal to this little island, and has from 10 fathoms, close to the shoal, to 12 and 13 in the middle of the road; and from 5 to 9 fathoms at about 1½ miles to the North and N.W. of the Isle of Aix. There are 6 fathoms at half a league West from the island, and good ground.

The soundings in midchannel, between the Isles of Ré and Oleron, are generally from 12 to 15 fathoms, shoaling toward each side. This channel is nearly 2 leagues in breadth. The French Man-of-War Road is on the South side of the Isle of Aix.

THE FOLLOWING DESCRIPTION of Basque Roads, &c., is from the pen of Captain W. H. Smyth, R.N., K.S.F., &c., by whom it has been most obligingly communicated.

Basque Road is a fine anchorage, at the confluence of the Charente River, with a good hard bottom, carrying from 8 to 20 fathoms, at low water, spring tides. It is formed by the coasts of La Vendée and Charente to the North, East, and South; and to the westward by the Islands of Oleron and Ré, on the extremities of which stand the Baleine and Chassiron Lighthouses. In sailing in, care must be taken to keep the mid-channel, in order to avoid the danger of Antioche and Grignion Shoals. The French shipping ride under the protection of the small but strongly-fortified Island of Aix.

ROCHEFORT, where the French fleet is equipped and constructed, is about 16 miles from Aix, and possesses very considerable and commodious arsenals. ROCHELLE has a capacious haven, surrounded by a prodigious mole, reported to be 5,400 feet in length, but it has not depth of water for large vessels. It, however, answers the purpose, as the trade from hence, and, in fact, all the coast, is carried on, during war, in small convoys of chasse-marées, under the protection of gun-brigs, prames, &c., which coast along, generally, within range of their own batteries. Their principal cargoes consist of wine, brandy, sugar, salt (of which abundance is made at Ré), coarse cloth, and a few other commodities. OLERON once belonged to the English, and was rendered famous, during the crusades, by the construction of the first maritime code of all the European nations, generally known by the appellation of the *Laws of Oleron*, issued by Richard the First of England. This is a populous and fertile island, about 15 miles long and 5 broad; the number of its inhabitants is generally estimated at 12,000; the chief town is defended by several forts and a strong castle.

THE GIRONDE, AND NAVIGATION TO BORDEAUX.—The lighthouses, named the *Tour de Chassiron*, on the North end of Oleron, and the *Tour de Cordouan*, at the mouth of the Gironde, have been noticed in the present work, but their uses are more fully explained in our *Directory for the Bay of Biscay*. On the Island of Oleron, as we are informed by Captain Livingston, there are seven windmills, very near each other. The shore is low, with sand-hills near it; and from the *Maumusson Passage*, at the South end of the island, to *Coubre Point*, at the mouth of the Gironde, is all sand, with little hills or hummocks of the same, of no great height, the size and shape of which probably vary with every gale of wind.

After opening the land up the river, beyond the light-tower on Coubre Point, some spots covered with trees or bushes form a verdant contrast to the arid sand. One of these spots is only a short distance inland from the tower.

Terre Negre, on the North shore, is about 7 miles to the south-eastward of Point Coubre. At one place, near this, the bottom of the river is of flat rock, so that no anchor will hold. At that place, *M. Pontjuet*, a pilot, said there were 18 fathoms of water, and a little below only 15. Here were such ripples and overfalls, that I should have been very much alarmed if no pilot had been on board.

On the opposite side of the North Channel is the *Bank of Montreviel.* The steeple of St. Palais just on with a small wood, which is sufficiently remarkable, is the leading-mark or *enfilation* for the shoalest part of this bank, which is by far the most dangerous of any in the vicinity. It has spots of very little water, and both ebb and flood set directly on it. By the lead it appears to consist of sand; but *M. Beaupré*, on his late survey, pierced the sand with a lance, to which a weight of 200 lb. was attached, and found rock above 4 feet under the North part of its surface.

The sail up from Royan to Bordeaux is delightful; the scenery on the left or eastern bank is particularly fine. At one place, a great deal of a fine white soft freestone is quarried, not as with us, out of open quarries, but out of caves; and when they cease working a cave, poor people take possession of it, build a neat front like a cottage to it, carry a long chimney-stalk up the side of the rock, and externally they appear very comfortable: of the interior we can say nothing, but they really have a very picturesque appearance.

The Semaphore Tower on Point de Grave is now converted into a lighthouse, and exhibits an excellent fixed light. There is also a small light at Royan, merely intended for the use of the pilots; and a floating light on the Tallais Bank, and also a red light at *Richard* just above it, on the western bank of the river, have been announced as in operation.

The CURRENT generally sets N.N.W. off the mouth of the Gironde; and, with southerly winds, it is scarcely possible for one of the pilot boats, which sail and will lie near the wind (being rigged with two lugsails), to beat up to the river from Oleron; and it is always advisable to make the Cordouan Tower, or rather to proceed even more to the southward, than directly to make Coubre Point; the shoal from which breaks very heavily, for a long way out, in bad weather.

The BASSIN D'ARCACHON is briefly described in the *Sailing Directory.* There is a fixed light on the North side of the entrance. Of this place M. Pontjuet, the pilot, says he has been in with his boat: the North channel is widest, but the southern one has most water; indeed, he says, 14 feet; but it is so extremely narrow, that it is impossible to tack; and a vessel must have the wind aft, and keep close along by the South shore, almost rubbing her sides with the sand. There are plenty of fine sweet but small oysters there. When you are once in, the appearance of the Bassin is beautiful.—*Letter of Captain Livingston, August*, 1828.

BAYONNE.—The little Harbour of Bayonne may, in time of peace, afford shelter to small vessels, which are towed in by stout boats under certain regulations.* The land in the vicinity is low and level, excepting some little downs, covered with pines and other trees, which are rather more elevated than the rest.

The River Adour passes through Bayonne. Its entrance lies between two level sandy hillocks. At times, the broken water extends a mile out from the mouth of the river, and the boats cannot get out. For the accommodation of vessels entering, in this case, there is a square pyramidal tower, having a flagstaff on its top, situated on a small sandy hillock, on the S.W. bank of the river, about a mile from its mouth, and various signals are made, as shown in the Book of Directions. The bar should not be approached by a stranger nearer than just sufficient to distinguish the signals. These indicate whether a vessel may venture in, or must stand off. A vessel which, from tempestuous weather, may not be able to force the bar, should, if the wind permit, put into the Port of *Passage*, in Spain, whence a coasting pilot will be sent, with instructions to conduct her to Bayonne.

It is strongly recommended to captains bound to Bayonne, particularly in winter and with westerly winds, to make the land on the coast of Spain, between Cape Machichaco and San Sebastian; that, in case the weather should become tempestuous, and crossing the Bar of Bayonne dangerous, they may have to leeward of them, either the ports of San Sebastian and Passage in Spain, or St. Jean de Luz and Socoa in France, from which ports they will be sure of obtaining pilots.

Within the piers of Bayonne you are out of danger, and may anchor where most convenient, in 4½ or 5 fathoms, a depth which continues up to the town. The latter is handsome, at about a league from the sea. There are said to be only 3 or 4 feet over the bar at low water.

* See the *New Directory for the Bay of Biscay*, already noticed.

The *Revolving Light of Biarritz*, on *Point St. Martin*, is exceedingly useful as a guide to the Adour or River of Bayonne.

COAST OF SPAIN.—Off the North coast of Spain, which is high, bold, and rocky, the depth of water, in general, is from 150 to 200 fathoms, foul ground and coral; but, in many places, there is no ground at that depth, even near the shore. The principal harbours on this coast are those of *Bilbao* and *Santander;* yet both of these are devious and shoal.

BILBAO.—Its entrance, which is 3 miles wide, is formed by the points, named Luzuero and Galea. On *Cape Machichaco* is a lighthouse, first used in 1852, showing a fixed light, with bright flash every four minutes. The greater part of its coast is lofty, steep, and rocky; but the bottom of the bay, on the eastern side, is low and sandy.

The mouth of the River Bilbao is impeded by a shifting bar, having less than 1 fathom over it, at low water. Here are two piers or kays, within which is the town of PORTUGALETE, and off which is the best anchorage in the harbour. Spring tides rise about 13 feet. In winter, a heavy sea sets into the bay, which, at times, renders it impossible for the pilots to go off.

If coming in, when the tide does not serve for taking the bar, with an unfavourable wind, you may come-to in the bay, midway between the outer points, Luzuero and Galea; bring the latter in a line with Cape Villano, in 16 fathoms, with sandy bottom. There is here sufficient room, in case a heavy on-shore wind should bring home the anchor or part the cable, to let go a second anchor, before the ship can get ashore. In summer, you may lie nearer to the land, in from 10 to 12 fathoms, all the bottom being of sand.

On making the bay from the westward, POINT GALEA, on the eastern side, may be readily known by its white colour. On it stands a lighthouse, with a fixed light (1852). Should you pass Santona, the bay may be thence distinguished by three sharp-pointed mountains; of these, the northernmost is that of LUZUERO, the middle one and highest, the hill of SERANTES, on the West side of the bay. The southern one appears like an island. On steering for the first, you will, of course, make Point Luzuero.

SANTANDER.—Of this harbour a particular plan is given on the New Chart of the Bay of Biscay. Cape Mayor, or the Great Cape, on the western side of its entrance, lies in lat. 43° 30′ 10″, lon. 3° 40′. This cape is of moderate elevation, but steep, and distinguished by its lighthouse. Cape Menor, or Little Cape, half a mile more to the S.E., has a battery on it. This is lower than Cape Mayor, and terminates in a low flat point, with a small reef of rocks below it.

On the same side, at the distance of $1\frac{3}{10}$ miles to the south-eastward of Cape Menor, is Point Puerto. The land between forms the sandy BAY of SARDINERO, in which vessels anchor, when the wind and tide do not serve for going into the harbour. The best anchorage here is with the Capes Menor and Mayor in one; and, at 3 cables' length from the former, you will find from 10 to 12 fathoms, bottom of sand; but more to the southward, it is all of rock or stone.

The extensive sands on the South side of the harbour frequently shift, and a great portion of them is dry, at low water. On the North side, from Point Puerto eastward, the coast is rocky, and defended by several batteries. The town has a small pier.

With the wind blowing fresh from the S.W. or N.W. quarters, it is impossible to take the *harbour* of Santander; but vessels may, with flood tide, occasionally bring up in the Road of the Promontory, which is clean and roomy, and there wait for a wind. With an ebb tide, it will be better to come-to in the outer bay, off the beach of Sardinero, as already described.

An islet, named *Mouro*, which is high and steep, lies in the entrance, at half a mile N.E. from Puerto Point; close to its eastern side is a large rock, and there is a shoal at a cable's length to the N.W. of it; otherwise there is deep water around it, and the channels on each side are clear and good.

Although Santander has been considered as the best harbour on the North coast of Spain, eastward of Cape Ortegal, there is little doubt that it is now filling up, and that the channel and even the anchorage now used may, in a few years, become impracticable.

On *Cape Penas* is a revolving light, visible every two minutes (1852), and on Cape Estaca is a *revolving* light also shown in 1852.

CAPE ORTEGAL, Cape Prior, with the other headlands in the vicinity, are high

and steep. The ground without generally rocky and foul. At the foot of Cape Ortegal are nine or ten sharp-pointed rocks above water, with 15 or 16 fathoms close to them; and there is a rocky shoal at half a mile N. by E. [*N. by W.*] from the cape. A watch-tower on the highest land, at 1¾ miles from the cape to the southward, is a good mark for distinguishing it from sea-ward. Hence to Cedeira the land is steep and rugged, but to the northward of Cape Prior it falls into sandy bays. At different distances from shore are many scattered rocks, on which the sea breaks in a swell.

Both the stream of tide and current of the sea set in toward the land of this coast: so that the utmost attention is requisite, in order to avoid being embayed with light winds. With a good steady breeze, large ships may, however, pass safely within 2 miles of Cape Ortegal.

FERROL.—From Cape Prior to the Harbour of Ferrol the land is highly mountainous, with large rocks above water, along-shore. The bay, forming the entrance of Ferrol Harbour, is only a mile wide; and the channel from it into the harbour but 2 cables' length in its narrowest part. There is, nevertheless, sufficient depth in mid-channel for large ships, at all times of the tide, viz., 8 to 10 and 12 fathoms. When within, you keep over to the North side, where you may haul up, and anchor in from 4 to 6 fathoms, sheltered from all winds.

CORUNNA, &c.—The North part of the Peninsula of Corunna is distinguished by the remarkable lighthouse called the *Tower of Hercules*, constructed with three sides, and exhibiting a revolving light. On the coast, without the elevation on which the lighthouse stands, there is a bank of rocks extending N.W. to a considerable distance; but, from the meridian of the lighthouse, a ship may range along the coast into the harbour, to the S.E. and South, and find anchorage with the town bearing S.W. in 14 and 15 fathoms.*

GENERAL REMARKS ON COMING IN WITH THE COAST ABOUT FERROL AND CORUNNA; from the Spanish of TOFIÑO.—" During the night, ships should never advance too near the land; for not only does, at times, a powerful current set in for the land from the N.W., but the streams of flood and ebb often draw vessels out of their computed situation, especially in winter, or in thick foggy weather, which is frequent here. In the day-time, the sandy beach at the bottom of the hills may often be seen, when the latter are obscured in mist and haze. Ships from the westward, which cannot take the harbours in the day, should not advance to the eastward of the meridian of Cape St. Adrian, or about Cisargas Isle (8° 44′), where they should stand off and on according to the state of the wind; for lying-to may be dangerous.

" During south-westerly winds, the currents set with great strength between Cisargas Isle and Cape Ortegal: and vessels have often been carried thus to leeward of the harbour of Ferrol, where there is no place of shelter or safety. With north-easterly winds a ship should run within 2 miles of Cape Prior, and thence steer for Cape Priorino, in order, if the wind be not very strong, to gain the anchorage in the Bay of Carino; or to stand away, if it be so, for Corunna.

" In the neighbourhood of Cisargas Isle and Cape Prior, as well as off the intermediate points, it is necessary, in hazy weather, to sound frequently; for the soundings will be a monition before the roaring of the sea on the shore can be heard."

From CAPE ST. ADRIAN, the high land continues to the Bay of Camarinas, with rocks above and under water. CAPE VILLANO is of rock, not very high, but perpendicular toward the sea. Within it, at a short distance, is a sharp peak, of a red colour, which, at a distance, appears like a tower. At the distance of a cable and a half N.N.W. from the cape is the *Rock of Bufardo*, steep-to, and over which the sea breaks.

CAPE TORIANA, which is 3 leagues to the S.W. by W. [*S.W. by S.*] from Cape Villano, makes a sharp and steep projection into the sea; it is not very high. At a distance it is not always distinguishable from the high land at the back of it. At two cables' length West from the point of the cape is a small sunken rock, which breaks with a little swell.

The NAVÉ OF FINISTERRE, a high mountain so named, stands at the distance of 5¾

* See the Charts of the Bay of Biscay and the Coasts of Spain and Portugal, with the Harbours, on enlarged scales, lately published by Mr. Laurie.

miles to the S.S.W. [*South*] from Cape Toriana. Its summit is flat; and, at about one-third of its height from the sea, there appears to be a short point with hummocks on it, and having at its base a small but high island. In the bay formed between Cape Toriana and the Navé of Finisterre, vessels may safely anchor during north-easterly and easterly winds, off a fresh-water rivulet, in from 6 to 8 fathoms, sandy bottom, but not in deeper water, as there the bottom is rocky. Care must also be taken not to advance too near the North shore, as it also is foul.

CAPE FINISTERRE is only half a league South of the Navé. It may be readily known from the sea; because there is a bight between it and the Navé, with low beach, and the land behind less elevated. As there are no other points like these on the neighbouring coast, they cannot easily be mistaken. There is a lighthouse constructing on it (1851).

PORTUGAL.—THE COAST OF PORTUGAL is variegated with rocky prominences falling away into low sandy bays. Its harbours universally require the aid of pilots. Such are Viana, Oporto, Aveiro, and even Lisbon. The latter has, however, a good channel with 6 fathoms over the bar at low water, yet it should not be attempted by a stranger, lest the winds fall calm, and the strength of the current set him on the banks. Here the powerful operation of the tides has caused the destruction of many ships. Off the city the ebb runs down at the rate of 7 knots, and the danger in entering is when a strong ebb is running down, opposed to a strong wind from the sea, which makes a complete break, sometimes all over the bar. Under these circumstances a vessel is almost unmanageable, and the tide may sheer her about; but in the middle of the Great or South Channel, the tide sets directly through. To enter the river, during the ebb, would require a brisk gale and all sails set, in order to make any way, or even to stem the current; and it is to be observed, that, within the river, the wind comes very irregularly through the valleys on each side, unless it proceeds from the West or S.W. It is, however, tolerably steady when in the direction of the river.—(See, further, the *Directory for Spain and Portugal*, pages 14, 15.)*

CAPE ST. VINCENT.—A light is shown from the convent, revolving every two minutes, at 221 feet. "Soundings extend to a considerable distance from Cape St. Vincent. To the southward of the cape fishing-boats may frequently be seen at anchor, fishing about 8 miles off shore.

"Off the cape, to the westward, the surf, by beating on the precipitous and cavernous rocks, may sometimes be heard to a surprising distance."—*A. L.*

LAGOS.†—According to the latest observations of ⊙ and ☽ and ✶ ☽ ✶, Lagos is in lat. 37° 8′ 40″ N., lon. 8° 37′ 45″ W., which differs a few seconds from the position generally adopted, and which appears in the tables of the scientific; but, from a number of coincidences, I should prefer this in a final determination. This place, and Villa Nueva, in time of war with Spain, are of the utmost value and import, more particularly if there is a blockade of Cadiz, as ships are despatched there to water; on which occasion it is necessary to observe the following instructions. At half-flood the boats can get near enough to land the casks, and may be taken off as late as quarter-ebb. The tide ebbs and flows in Lagos River at two o'clock, full and change: it rises about 13½ feet in the spring, and 9 in the neaps. The bar is just covered at low water. It has 14 feet on it at high water spring tides, and 10 feet at the neaps. In fine weather, about 180 tons of water may be rafted off in twenty-four hours. Refreshments, such as poultry, pigs, fruit, rabbits, pigeons, vegetables, &c., are to be procured reasonably.

VILLA NUEVA.—In Villa Nueva River, water may be got in transports, at about 150 butts in twenty-four hours; which must be rafted 3 or 4 miles down the river with the ebb tide, as the water is too shoal for ships to go nearer the fountain where it is procured. There is a depth of 16 or 18 feet of water on the bar; but, in my opinion, it is only a summer watering-place: as the Portuguese told me, that, in winter, the bar

* On the 4th of November, 1839, a notice was given to the chairman of Lloyd's, by order of the Lords of the Committee of Privy Council for Trade, that the government of Portugal now require the masters of all foreign vessels, entering the ports of that kingdom and its dominions, to bring their manifestoes in duplicate.—Signed, *Denis Le Marchant*.

† The descriptions of Lagos, Villa Nueva, Trafalgar, and Tangier, have been communicated by Captain W. H. Smyth, R.N., K.S.F., &c.

is seldom passable for ships, as the breakers are very dangerous, and the swell a long way outside it. At the lower watering-place a butt may be filled in eight minutes, and in seven at the upper. A great quantity of salt is shipped at Villa Nueva.

SAN LUCAR, or the PORT OF SEVILLE.—A vessel bound for San Lucar, or Seville, should, after sighting land, bring the town of San Lucar just open of the point on which stands the ruin of the Fort of Espirito Santo, when a large stone building (not whitewashed) will be seen; it is the easternmost in the town of San Lucar, and cannot be mistaken, as all the others are whitewashed; bring this in a line over the North edge of the Point Espirito Santo, and run boldly in in that direction, until a large square white building is seen at Bonanza, just clear or touching the low sandy point to the northward, covered with trees, called *Point Seville;* then run with this last mark on, keeping the square building in sight, and pass Point Seville at 1½ cables' length; then run over to Bonanza, and anchor in 5 or 7 fathoms before the square building or pier. The square building of Bonanza is close to the river, and about 1½ miles from San Lucar.

The water breaks on *Picacho* till half-flood;—when there is any sea on, leave it on the larboard side.

It is best to wait till flood tide to run in with; we had 22 feet water, at quarter-ebb, and beat out, opening and shutting the square building at Bonanza with Point Seville. The South side of the entrance of the river is bordered by low black rocks, covered at quarter-flood. Weather permitting, a pilot may always be obtained, but they only put off when a ship is bound to the port.

It is recommended that no ship taking the Bar of San Lucar should attempt it on the ebb tide, especially if they have any suspicion that there are freshes in the river, because, with a broken sea and strong tide, a vessel may sheer on shore before she could recover herself.*

TRAFALGAR.—Cape Trafalgar, by the ancients called the *Promontory of Juno*, is about 15 or 16 miles to the eastward of Cadiz, and 23 or 24 miles to the southward of it; its appearance is flat, and distinguished by a white building. Those unacquainted with the navigation between this and Cape St. Mary, generally labour under great dread of a gale of wind from the S.W., and from want of knowing how these gales come on, frequently get into difficulties. The S.W. gales generally commence with the wind at S. by W. or S.S.W., and continue blowing on these points five or six hours, although the sea sets in from the westward; and it is too common for persons, unaccustomed to navigate in this bight, to have their minds impressed with the danger of the shoals lying off Point Regla, commonly called the shoals of San Lucar, and falsely represented as very alarming. Under this apprehension they are induced to haul their *starboard tacks* on board, and push for the Strait of Gibraltar; whereas the real danger lies at the entrance of this strait, and consists of dangerous reefs of rocks, with uncertain soundings, in no wise to be depended on. Between Cape Trafalgar and Tarifa (and when you suppose yourself round them, and the straits open), in thick weather, not able to see land on either side, you will feel yourself in a very awkward situation to find out the drift of the ship, or ascertain whether you are in a fair way to push through the gut; which you will be compelled to do, should the gale continue, and you are within the influence of the stream; for you can (as before observed) gain no information by the lead of the reef of rocks which lie W. by N. of the Island of Tarifa, and are extremely dangerous. On the other hand, by standing to the westward, with the *larboard tacks* on board, at the commencement of a S.W. gale, when the wind is from the southward, for instance, at S.W. by S., and you make four points leeway, you will make a fetch to the westward of Ayamonte; or even with a N.W. course made good, you will weather the Bar of Huelba, and the lead will inform you the distance the ship is off the land, 15 fathoms being the very shoalest part you should stand into along the North shore.

The outer shoal of San Lucar is not at a greater distance than 2¼ miles N.N.W. [*N. W.*] from Point Regla; the ground, outside the shoal, is even and hard, with 10 fathoms of water close to it; about half a mile to the northward of it there is a spot with 8 fathoms. No allowance is made for a S.E. current, which always prevails when out of soundings, and even in 60 fathoms.

A more particular description of the land between Cape St. Mary (on which there is

* These Directions for San Lucar have been communicated by Captain *J. Wharton*, of the *Romp*, June, 1845.

a fixed light) and Cadiz may be found in the Sailing Directory. *Cape Trafalgar*, the last great promontory of this coast, may be known by its remarkable figure, being flat, and terminating with two sharp corners or angles. A round tower stands on the East corner; to the eastward of the flat, the land is very uneven and mountainous. To the East of the flat land are high sandy cliffs, but none to the westward.

E. ½ N. *Cape Trafalgar, with the pitch and Tower E. ¾ S. about 3 leagues.* *E. ¾ S.*

It is to be noted that the southern side of the reefs called the *Cabezos*, lies 5½ miles W.N.W. [*West*] from the light-tower of Tarifa. This appears to be the spot on which the British frigate *Thisbe* touched, in August, 1804; the depth over which was estimated at 14 feet.

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2. THE COASTS OF AFRICA, FROM TANGIER TO CAPE MESURADO.

Before proceeding with the description of the coast of Marocco, we will direct the attention to the following notice, issued by the British Consul, and which notice ought to be borne in mind by all frequenting these coasts:—

"In consequence of several boats' crews having landed lately, from shipping of various nations, on the open coast of Marocco, or West Barbary, in search, it is supposed, of water or other provisions, the Moorish authorities are desirous that all persons be cautioned that it is not only against the law of this land, and against the sanatory regulations, to land on any part of this coast, in places where there is not a port for their reception, but that, in consequence of the strict injunctions given to the people of this country by their government to prevent any persons whatever setting foot on land, or approaching near to it on the open coast, the lives of those who infringe the laws in such respect are exposed to danger.

"The undersigned feels it, therefore, his duty to give all the publicity he can to this notice, for warning all commanders and masters of vessels, and especially those navigating under the flags either of the United Kingdom of Great Britain and Ireland, or of the Kingdom of Hanover, or of the Hanseatic Republics of Lubeck, Bremen, and Hamburg, not to venture, upon any account, to land, or allow any person under their care or orders to land, or approach within musket-shot of the coast of Marocco or West Barbary, excepting within the harbours of any of the well-known ports of this country.

(Signed) "E. W. DRUMMOND HAY,
"*Tangier, Sept.* 15, 1843." "*Her Britannic Majesty's Consul-General, &c.*

TANGIER.—This place is of importance to the navigator, both in peace and war, on account of the refreshments to be procured, which are almost the only traffic the Moors have. The principal articles are cattle, sheep, pigs, poultry, eggs, fruit, and vegetables, of which a limited quantity is allowed to be purchased by each ship.

The bay affords convenient anchorage for vessels of all sizes opposite to the town, in from 8 to 10 fathoms, sand; but it is to be observed that, on the eastern side, there is a rocky ledge, bearing S.E. by E. ½ E. from Tangier Point, and S.W. by W. ½ W. from *Cape Malabat.* This cape, in a line with Europa Point, Gibraltar, leads clear of the shoal; and the anchorage, therefore, lies with Gibraltar open of the cape. Ships moor to the N.W. and S.E., with the longest cable to the N.W.; and it is proper to buoy up and protect the cables, as they may be exposed to injury from the hard roots of large sea-weeds, which grow in the bottom of the bay, as well as from coral, &c.*

* It is to be observed that the proper anchorage is in the centre of the bay. On the West of this anchorage is, or lately was, a large old mooring chain, supposed to have been laid down in the Reign of Charles II., King of England, and found to extend nearly in an East and West direction, and in a line on the North side of the town of Tangier; its West end being nearly a mile from the nearest shore. Tangier Point is altogether surrounded by foul ground, to a considerable distance.

Tangier is described by *Captain Washington** as situate on a deep acclivity, rising at once from the beach, and presenting its eastern and not unpleasing aspect to a bay about 3 miles wide. It is surrounded by mouldering walls, round and square towers every 60 paces, and three strong gates. Its defences toward the sea are two batteries, one above the other, on the South side of the sea-gate. Directly in front of the landing-place, high on the wall, are about twelve guns; to the North, in a circular battery commanding the bay, about twenty guns of all calibres, mounted on clumsy Moorish carriages, which would not stand fire for ten minutes; crowning all, to the North, is an old and extensive castle, *L'Kassbah*, and the residence of the governor. On the land side, ruined walls and a ditch are the only defences. The gates are shut at sunset, and a watch is kept by night.

All persons who visit this place should pay implicit obedience to the advice of the consul, as to the conduct to be observed during their intercourse with the natives.

In rounding Cape Malabat, some years since, at the distance of more than three-quarters of a mile from the shore, the *Excellent*, of seventy-four guns, touched upon a rock previously unknown; at which time, from the starboard chains, were found 5½ fathoms, and 6 from the larboard. Cape Malabat then bore S. by E. ½ E., and the ship floated off in less than a minute. This rock is now known by the name of the *Almirante*, and described as having over its shoalest part 3 fathoms of water. There is also a sunken rock at nearly the same distance from Tangier Point, discovered by the *Pacifico* schooner, in 1818, and which lies with the inner coast of Tangier S. by. W. [*S. by E.*]

In all the extent between Cape Spartel and Cape Cantin (lat. 32° 35′), as shown on the chart, there are regular soundings toward the shore. In this track there are no harbours of consequence; those which exist being nearly choked up with sand. On sailing along, the inland mountains may be seen at a great distance, covered with snow, even in April and May.

CAPE SPARTEL, the N.W. point of the state of Marocco, is situate in lat. 35° 47′ 40″, and lon. 5° 54′ 40″ W. The cape, at a distance, appears like an island, and is so high as to be seen, in clear weather, at the distance of 14 or 15 leagues. The outer point, when seen from a short distance westward, appears uneven, with eminences on it like hummocks, and the high lands resemble the awning of a galley. The ground about the cape is quite clear, with the exception of some high rocks, steep-to.

Around the West side, and at about one-third of the whole height from the summit, is a range of well-defined basaltic columns, appearing like a coronet. At the distance of 2 miles from shore are 98 fathoms, the bank immediately dropping to an unfathomable depth. To the southward of the cape the bank extends much farther off, and there is excellent anchorage on a bottom of mud and sand, and shelter from easterly winds.

The following descriptions of the coast between the parallels of 36° and 28° (those of Cape Spartel and Cape Juba), we owe principally to the Survey of Lieutenants W. Arlett, in the *Ætna*, and H. Kellett, in the *Raven*, 1835-36; and to the notices of Mr. T. J. Evans, of H.M.S. *Dido*, 1837-38.†

From Cape Spartel the direction of the coast is S.W. 20 miles to *Arzilla*, a small fortified town situate close to the shore, between which and Cape Spartel there is good anchorage all along with an easterly wind. The depths of water are regular, 10 to 15 fathoms, over a sandy bottom, at 1 or 2 miles off shore. The coast-line is a flat, sandy, and shingly beach, rising to a fine grazing country in the interior.

The Roadstead of Jeremia, the usual anchorage near Cape Spartel, extends from it 8 or 10 miles to the S.W. The *Dido* anchored in the following positions in smooth water, and well sheltered from a strong levanter, or easterly wind.

1st.—In 15 fathoms, sand and small shells, Cape Spartel bearing N.E. ½ N.; the town of Arzilla, S. by W. ¾ W.; extremity of land to the right, two points nearly in a line, S.W. by S. Distance to the nearest shore about 1½ miles; soundings very regular to a depth of 5 fathoms, at 2 cables' length from shore.

* See Note 2, page 48.

† The first of these was given in the *Journal of the Royal Geographical Society*, vol. vi. 1836, and the second in the *Nautical Magazine* of June, 1839. We have, of course, incorporated such other information as would render the description complete.—(See Notes on the Table of Positions, page 49.)

2nd.—In 13 fathoms, coral rock, gravel, and sand, Cape Spartel bearing N.E. ¾ N.; centre of the town of Arzilla, S. ¼ E.; two bold and prominent points to the S.W. of the town, nearly in a line S.S.W. ½ W.

At the village of *Almadronis*, nearly midway between Cape Spartel and Arzilla, landing can be effected. A boat of the *Dido*, sounding in this vicinity, landed, and numerous herds of cattle were seen grazing in the vicinity; but on two officers and two seamen, part of the boat's crew, walking not more than 100 yards from the beach, in hopes of procuring stock, they were immediately seized by a party of Moors; three were detained and conveyed into the country, the fourth having effected his escape. The Moors were armed, and were savage in their behaviour until they had made their prisoners. The ship, then lying at her first anchorage, was soon under way, and ran down off Arzilla, demanding from the governor the officer and men detained. A party of Moorish horsemen were now sent to scour the country, who found them on their road to Tangier, under a guard: on this they were escorted back to Arzilla, but were refused to be delivered up until permission was granted by the governor of Tangier. The delays were so protracted that the ship anchored off the town, to make a serious demonstration, in 4½ fathoms of water, at about 600 yards from the shore, and 150 yards outside a reef of rocks awash, which describe a semicircle without the beach-line, affording good shelter under its lee, with the principal fortress bearing S. ½ W.

"The fortifications, which apparently are fast crumbling to decay, cover the whole sea-face of the town, on which we observed mounted about twenty guns, of various calibres: in our position not more than thirteen guns bore on us; and if we had anchored about half a cable farther North, not more than ten could have been used with effect. However, the garrison being deficient in ammunition, and defenceless in other points, the ship resumed her former anchorage, having gradual soundings, in all directions, from the reef of rock to a depth of 15 fathoms.

"The next day we received our people by permission of the authorities of Tangier, and started from their inhospitable shore. It is here necessary to state, that, while prisoners, they had been well treated.

"To account for the foregoing proceedings, it appears, by a treaty, that trading is forbidden at any port on the Moorish coast at which there is not a British consul, or his agent. At Arzilla there is a Spanish Jew in the latter capacity, who behaved uncommonly well on this occasion. Now, as we landed only 5 miles from an authorized port, it appears that they carried this article of the treaty to its fullest extent. In fact, it is generally attended with fatal consequences for a Frank, on an unauthorized port, on any pretence, whether from distress or a want of knowledge of their customs. An instance of barbarous murder committed on an Englishman who (in ignorance) had landed for the amusement of collecting shells on the sea-beach, and actually in sight of the ship, occurred a few years back, not 3 miles from where our party were seized; and it may be considered fortunate that this affair ended without loss of life. As a proof of the general ignorance of this custom, we had on board at the time of the above incident five merchant captains, who had been in the habit of trading to the S.W. ports of Marocco, and who knew not that landing was against the laws; and it is to be regretted that our consuls in Marocco should not have given more general information on so serious a point."*

Four or five miles to the N.E. of Arzilla is the *Wed el Ayasha*, a small river, barred across the entrance, but reported to flow sufficiently strong for a good supply of water; and the distance to roll the casks, the boat been anchored clear of the surf, not above 50 yards. The preceding description shows how far caution may be required.

Twelve miles inland from Arzilla is the *Jibel Habib*, a range of mountains very conspicuous from the sea, the loftiest of which is 3,170 feet above the sea. *Jibel Hasan*, another peak in this range, more to the northward, is 2,270 feet high. Just to the North of the town of Arzilla is a castle in ruins; and date trees, which overtop the walls, are growing in the court. On the wall fronting the sea, which is strengthened by three towers, twenty guns are mounted. Under the southern angle of the wall is a well white-washed tomb. The country around is well wooded, and a quantity laid out in gardens. The population is supposed to exceed 600.†

* See the Notice lately issued by H.B.M. Consul, given on page 322.

† In the latitude of Arzilla the bank extends 12 miles from the land. Here is a mackerel fishery, on which twenty or thirty Spanish and Portuguese falucas are employed. The

From Arzilla the coast trends S.W. ½ W., and at the distance of 4 miles the coast hills rise to the height of 734 feet; at 5 miles farther is the *Haffa el Beida*, a remarkable white cliff, in the shape of a wedge, which rises to 308 feet above the sea, and presents the same form in all directions. It may be distinguished when 5 leagues off; but the best mark for the coast is the Peak of Fas, an insulated mountain, resembling a sugar-loaf, which stands S. by E. ½ E. [*S.E.* 2° *S.*] from off the entrance of El Araiche, next described.

El Araiche, a picturesque ruin, is situate on the steep southern point of the River *Al Khos*, which here meanders through a rich and fertile valley. *Al Khos* signifies *the bow; El Araiche*, the *pleasure garden;* but the people are barbarous, and the country is in an uncultivated state. The population of El Araiche is about 2,500; and a little trade is carried on between this town and Gibraltar. Supplies are abundant, and there is a fine spring of water on the northern shore, very convenient for shipping.

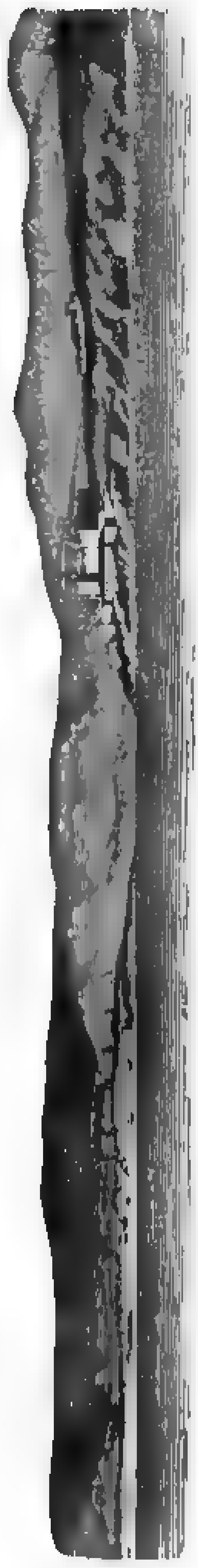
The best anchorage is with the town between the South and S.S.E. The mouth of the river, which appears very broad, is really very narrow at low water, and has then only 5 and 6 feet water over it, but there is a rise and fall of 9 to 12 feet. Inside the water deepens to 24 feet. A "pap," or rising point, on the North side of the river, is 204 feet high above the sea. The best anchorage in the roads for vessels intending to enter the river, is with the distant conical mountain, Fas, appearing in the centre of the entrance, 1 mile from the point, in 12 fathoms, sand.

Between Arzilla and El Araiche the ground is tolerably clean, but not very good, being coarse gravel, with 25 and 30 fathoms of water, at from 1 to 3 miles from shore. Before El Araiche the depth decreases, and there are only 4 fathoms at 2 cables' length from shore. In sailing along this coast, care must be taken not to advance too near, unless it should be with a strong easterly wind; for sometimes, in calm weather, there is here a heavy swell from the West or N.W., which would render it difficult to get off shore.

The site of *Old Mamora*, known by several whitewashed tombs, the chief of which is that of *Muley Bu Selham*, at the outlet of a stream said to flow from a small lake, 20 miles to the southward of El Araiche. At 2 cables' length from the bar is a depth of 5 fathoms, gradually increasing to 34 at 2 miles from shore. The coast between El Araiche and this spot is straight, and for the most part about 300 feet in height; reddish cliffs for the first 10 miles, then sand-hills partly covered with brushwood. There are everywhere from 20 to 25 fathoms of water, at half a league from shore, and you may anchor off the coast hence to Slaa or Salee. Ships, in fact, must sometimes anchor here, during a calm, to avoid being drifted by the currents, which set to the southward, along the coast; and the velocity of which, especially at the full and change of the moon, is frequently from 1 to 2 miles an hour.

The Peak of Fas, above mentioned, serves as a mark for Old Mamora, from which it bears nearly *true* East.

From this place the coast extends 10 leagues S.S.W. to *Mehedia*. The coast is very clear, a little higher than the former, and readily known, being of white sand as far as about the middle of its declivity, while the upper part appears like cliffs. The River Sebou, on the South bank of which the town is situate, is impassable, except in boats, or on rafts, at some distance from the sea, although navigable



View of El Araiche. A. *The Port.* B. *The Town.*

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method of taking the fish is by three hooks fastened together: the fisherman throws a handful of salt or sand into the water, to which the fish rise, and are immediately jigged with great dexterity. They are cleaned and salted on the spot.

near the ocean. The town extends from the sea-shore to the top of the highest land, so that you may readily distinguish, from the offing, the walls of an old castle, situate in the upper part of it. Ships may anchor, at half a league from shore, in 12 or 14 fathoms, sandy ground; but, when the wind blows from the offing, and sometimes in fair weather, the swell is here very great, as well as along the coast. The best anchorage is with the town from S.E. by E. to S.E. by S.

Mehedia was formerly a place of some consequence, and is noted for the ruins of fountains, arches, &c. The town now contains only 300 to 400 inhabitants, chiefly fishermen, who subsist by the sale of *shebbel*, an excellent fish, much like salmon, which is caught here in great abundance.

In the summer, the wind generally prevails from N. by E. to N.E. along the coast. During winter, there is a blustering S.W. and S.S.W. wind; and, in this season, when it begins to chop about to the South or S.E., shipping must get off, for then it commonly shifts to the S.W. and W.S.W., with foul weather. When it changes to W.N.W. or N.W., the weather is likely to be clear.

Between Mehedia and Slaa or Salee, the coast is rather low, with double land, very even, with a white sandy strand, therefore readily known. At about half-way the strand rises, and thence, southward, the shore consists of black and steep rugged rocks, with small hills.

SLAA and RABAT.—The towns of SLAA and RABAT are divided by the river called the *Bu Regreb*. In this river, between the two towns, some sloops of war, belonging to the Moorish sovereign, were formerly laid up for the winter. But Mr. Jackson has said that, going thence to Mogodor, a few years since, the vessel in which he was, of about 150 tons burden, struck three times on the bar: and, as the sand continues to accumulate, it is likely that, in another century, there will be a separation from the ocean at ebb tide.*

SLAA, or SALEE, says Captain Washington, once the terror of the seas, so renowned for its rovers, whose daring exploits reached even to our coasts; whose city and port were a constant scene of riot, and bustle, and activity; now ruined, still, and lifeless. The present town, built on a sandy point, extending to the sea, forming the north-eastern bank of the river, is about half a mile in length by a quarter in breadth, surrounded by walls 30 feet high, and square towers every 50 paces. Its defences, a battery of twenty guns, facing the sea, a round fort at the entrance of the river, and a gun or two on the gates. The mosques, arches, and fountains, in the city, show traces of beautiful sculpture, and of great antiquity. Streets narrow, and houses sombre, like all Moorish towns. Population about 10,000, of which 500 may be Jews, with apparently little or no occupation.

The river, called *Bu Regreb*, is here about 500 yards broad, when full. The bar, about one-eighth of a mile from the entrance, extends almost across in a W.S.W. direction, with 3 or 4 feet on it at low water, leaving a channel at each end; the Moors use the eastern. Rise of tide, 9 or 10 feet. From the anchorage off-shore the water shoalens very gradually till close to the bar, where it suddenly drops from 7 to 2 fathoms. Here is almost invariably a heavy surf.

RABAT, on the S.W. side of the river, is 50 or 60 feet above its level, on banks of crumbling sandstone. It is crowned by a venerable and battlemented *Kassbah*, or citadel. A curtain of 500 yards, facing the sea, flanked by two circular batteries of twelve guns each, about as many more in the Kassbah, and a small battery overlooking the river at the S.W. end of the town, form its sea-defences. The town is three-quarters of a mile long by one-third in breadth, and walled orchards of about 200 acres reach along the banks of the river.

The old Kassbah was built in the twelfth century, and some subterraneous magazines in it, remarkable for their strength, being bomb-proof, are still preserved; there are, also, the remains of a small battery, which defended the entrance of the river. At a short distance South of the castle, on an elevated situation, is a square fort, the walls of which are about 2 miles in circuit, and strengthened by square towers; they enclose the castle, the town of Rabat, and a large space of ground, where stand a palace, and the mausoleum of the Shareef or Emperor Sidi, or Seedy Mohammed.

A remarkable old tower at Rabat, called the *Tower of Beni Hassan*, is the best seamark for this place. It is built of hewn stone, is 180 feet in height, 35 or 36 feet broad.†

* See Mr. Jackson's description of Marocco, &c.

† A particular description of this tower, &c., is given by M. Cassini, in his voyage to New-foundland and Salee, 1768.

At a small distance to the northward of it are the ruins of an ancient wall, on which were formerly a battery and castle.

The country in the neighbourhood is planted with vines, oranges, and cotton, of an excellent quality. There are docks for ship-building, both at Salee and Rabat.

The tower before mentioned is described by Captain Washington as that of *Sma Hassan*, and is the most conspicuous object, standing 220 feet above the level of the river, and the first by which this coast would be recognised in approaching from sea, as it must be visible from the deck of a frigate 6 or 7 leagues. He adds, the main street of the town, which runs parallel to the river, contains the principal shops; not very attractive; the markets abundantly supplied with vegetables and fruit; orange orchards, vineyards, and cotton plantations, are extensive; the fruits excellent, though grown on a light, sandy soil. Moorish population, about 18,000; Jew, 3,000. The Jewesses the prettiest in the empire. There are ten mosques, besides the mausoleum of the sultan before mentioned, and that of the Moorish hero *Al Mansor.*

The Road of Slaa is dangerous for shipping, and the accumulation of sand at the entrance will scarcely permit a vessel of 100 tons to enter the river without danger. Vessels may lie in safety out of the river, near Rabat, from April to September inclusive; but they are not secure in the rest of the year, the wind blowing from the southern quarter, and often obliging them to quit their moorings. The best anchorage in this season is between the Mosque of Rabat and the old Tower of Hassan, keeping the former to the northward. As a great number of anchors have been lost in the road, much attention must be paid to the cables. The position of Slaa and Rabat may be seen in the Table, page 48.

El Mansoria, shown on the Chart, is a square of 150 paces, enclosing an Arab village. The tower of the mosque, 80 feet high, stands 180 feet above the sea, from which it is less than a mile distant. From the deck of a frigate it may be visible at 6 leagues. The coast here is iron-bound and rocky.

FIDALLAH, or Fedala, a peninsula, frequently mistaken for an island, forms a harbour, having a depth of 5 or 6 fathoms, which affords shelter to small vessels during westerly winds. A roadstead here is supposed to be the only one, with the exception of Agadeer, in the parallel of 30° 27′, wherein ships on the coast may ride in security during winter. This is owing to a projection of the land, South of the peninsula above mentioned.

The village of Fidallah, situate at three-quarters of a mile from the sea, is a walled square, of about 200 paces, enclosing a respectable mosque, the ruins of European merchants' houses, and an Arab encampment. It may, perhaps, contain 300 inhabitants—Moors, Arabs, and Jews.

Between Rabat and Point Fidallah there is no danger beyond a quarter of a mile from shore; the Bank of Soundings extends to the distance of 20 or 22 miles from the land, increasing south-westward. From 160 fathoms, mud, the water shoalens suddenly to 90 or 80 fathoms, between which depths and 60 fathoms it continues for many miles, sand and mud, decreasing to 30 fathoms at 3 miles from shore. The inland features vary slightly: two lines of barren and gently undulating hills, from 200 to 300 feet in height, extend nearly parallel to the coast; the more distant are from 4 to 6 miles from the sea, the nearer not more than a mile, sloping gradually to the beach, which is generally sandy, with occasional patches of rock.

Dar el Beida.—At 4 leagues W. by S. from Fidallah is *Dar el Beida*, or *Anafa*,* a small walled town on the beach, within a point projecting half a mile N.N.E., *true*, and forming a cove, three-quarters of a mile deep, and well sheltered from westerly winds. This town, as well as Fidallah, was built for the exportation of corn. The towers of three mosques are conspicuous, and one is of superior height. Around the town are many palm trees and gardens; water in abundance. Inhabitants, about 700, including Jews, among whom is a British consular agent.

This place is easily known by its towers, one of which seems almost as high as Hassan's

* *Dar el Beida*, i.e., white house. A vessel, the *Rose*, from Gibraltar, chartered for *Casa Bianca* (Italian, "white house"), not finding the name on his chart, made for Cape Blanco, and on landing, the captain and part of the crew were made prisoners, and liberated with difficulty. The notice from our consul-general, given on page 322, ought to be very strictly attended to.

Tower at Salee. The coast between is low, and bordered with small islets, all very near the land.

There is a reef of rocks at one-third of a mile off the town, and the landing-place is behind them. Some other parts of the bottom are likewise rocky, and in winter the anchorage is unsafe, owing to the current, &c. From the cape, rocks extend to the distance of nearly half a mile, and farther off is a rocky bank of 6 fathoms. At 20 miles to the West is a depth of 150 fathoms, dark sand, decreasing rapidly toward the land to 45 fathoms at 12 miles from shore, and then gradually to the beach.

AZAMOR.—On a sand-hill at about 13 leagues to the south-westward of Dar el Beida is the small town of Azamor, situate on the South side of the mouth of a river called by Mr. Jackson the *Morbeya*, and by Captain Washington *Wad-oom-er-begh.** Its walls, crumbling to ruin, are tenanted by storks. The place is dull and lifeless; streets narrow and dirty; but provisions, fish, vegetables, and fruit, abundant and good. The population about 1,000, including Jews. These carry on a considerable trade in wool, which is shipped from Mazagan. The inhabitants of the country around, who are of superior stature, are chiefly pastoral, possessing large flocks of sheep and goats, and mostly live in tents. Wood is scarce and dear.

The bar of the river is dry at low water. The entrance is dangerous, and the shore flat, having not above 8 or 10 fathoms of water for 1 or 1½ leagues from shore, and foul rocky ground, so that it is not safe to anchor hereabout.

MAZAGAN.—From Azamor to the remains of the town of Mazagan, on the S.W., the distance is 10 miles. This place is on a low rocky point, projecting to the North, which forms the western limit of a sandy cove, of about 1½ miles, and affording a good roadstead for small vessels. It is defended by several redoubts, enjoys a little commerce, excellent water, and good supplies. A large proportion of the buildings are used as storehouses for wool, of which great quantities are hence exported. There is a tank, admirably constructed, which will contain several thousand tons of water. A lofty building, 140 feet high, now in ruins, appears to have been a lighthouse. There is anchorage off the coast, at a league from the shore, in 15 fathoms, sandy ground; but at the West point of Mazagan is a ledge of rocks, which stretch to the N.E. [*N.N.E.*] about a league into the sea, and are uncovered at low water. A dangerous patch of rocks, because the sea only breaks on them at low water, in bad weather, lies 720 fathoms W.N.W. from the old light-tower. The best anchorage is to bring the two flagstaffs on the Sardinian consul's house in one, and anchor in 5 fathoms water; by doing so, you come upon a patch of blue clay, the rest of the bay being all rocky bottom without exception (June, 1839). The shore hence, toward Cape Blanco North, is everywhere rocky and dangerous, to a considerable distance from it; and ships that stop here must anchor at 2 leagues off, in 35 or 36 fathoms of water, oozy ground; the swell is almost always very great, and the currents very strong. From Mazagan to Cape Blanco, the distance is 4 leagues. The shore between is merely a ridge of sand-hills. About midway are the ruins of *Tett*, or *Tid*, an ancient town, and a conspicuous tower, 128 feet high and 148 feet above the sea, which may therefore be seen from a great distance. Two large tombs, kept whitewashed, stand on either side of it.

The coast hereabout should not be approached nearer than 1½ miles, as scattered rocks lie off the shore, and the bottom is very uneven. The beach, in some places sandy, is generally lined with craggy rocks. A line of barren hills, 200 feet high, slope to the beach along the whole distance, and terminate just to the northward of the cape in a low and dark but abrupt and rocky cliff.

CAPE BLANCO NORTH.—This is in lat. 33° 8′, a little to the southward of the headland last mentioned. It is 170 feet high, appears to be of white sandstone, and the lines of strata, white and red, rising parallel to the horizon for some distance, suddenly drop at nearly a right angle to the water, and the cliff appears like a wall. In a bight on the S.W., which is formed by the cape, is a good anchoring place, of sufficient extent for several ships.

At 22 miles westward of Cape Blanco are soundings of 150 fathoms, fine sand, gradually decreasing to 28 fathoms at 4 miles from the shore.

A dark and rather projecting cliff, formerly represented as an islet, under the name of *Duksal*, stands at about 4 miles southward from Cape Blanco: and, at 6 miles from the

* Or *Um' er' beigh;* 'Mother of Herbage.'

cape, hills rise gradually from the beach to the height of 465 feet, the greatest elevation on the western shore of Marocco. Hereabout are the ruins of *Woladia*, where it seems there was once a harbour. At 4 and 7 miles to the southward of these, on the edge of the cliff, are those of two other small towns, supposed to be Eder and Teturia.

CAPE CANTIN, &c.—RAS AL HUDIK,* or CAPE CANTIN, in lat. 32° 32½′, is a steep headland, which rises precipitously to 211 feet above the sea, and has a ledge of rocks projecting from it; on its summit is a small sepulchre. At 16 miles westward from the cape are soundings of 100 fathoms, fine sand; this depth gradually decreases eastward.

From the preceding description it will appear, that between Cape Blanco and Cape North the coast is much higher than the coast between Cape Blanco and El Araiche. It trends to the S.W. by W. ½ W. [*S.W. ½ S.*] 12½ leagues, and is safe all along, having only some small islets very near the land. At 2 leagues off the depths are 40 and 50 fathoms, oozy ground. The currents are very strong, and generally run in the direction of the coast, S.W. by S.

From Cape Cantin to the North point of ASFEE or SAFFI BAY the coast trends S.S.W. [*nearly South*] 4 leagues, and is much higher than the coast already described. Between these points, at the distance of a league from shore, is a rocky bank, extending North and South, *true*, having over it from 30 to 40 fathoms, and, at times, abounding with fish. From the North point of the bay (which is foul) to the town of Asfee, or Saffi, the distance to the S.S.E. is 2½ leagues.

The North cape of the Bay of Saffi forms two headlands; on the southern one is a tomb or sanctuary. The coast between Cape Cantin and the bay is one continued white cliff, with a sandy beach at its base; the cliff, rising gradually to its southern projection, is there 530 feet in height, and here the bay commences. In the bight within is a ravine, the bed of a winter torrent; and on the slope stands the ancient town of Saffi, in lat. 32° 18′ or 32° 19′, between two hills, which render it intolerably hot; and, in winter, very disagreeable, as the waters from the neighbouring mountains, occasioned by the rains, discharge themselves through the main street into the sea. The road is safe in summer; but, in winter, when the wind is from South or S.W., vessels are frequently obliged to make off to sea.

Saffi is a considerable town, surrounded by a wall 31 feet high, with a ditch, and defended by twenty-four heavy guns next the sea. The tower of one mosque is 209 feet above the surface. Fresh water is scarce, and procured from wells southward of the town. The country in the immediate vicinity appears sandy and barren; but the interior abounds in corn, and two falls of rain in a year are said to be sufficient to bring it to maturity. The population of the town, which has gradually decreased, is now supposed to exceed 9,000 persons.

During the summer months, or from March to October, the bay affords as good anchorage, and smoother water, than any other on the coast, but is entirely exposed to westerly winds; the bottom is of sand and mud, and there is generally a depth of about 15 fathoms at a mile from shore. Vessels may anchor at a league from the town, in 20 or 22 fathoms of water, gray and oozy sand. To anchor in the road, the North point, on which stands a low tower, must be brought a little to the northward of N.N.E. Or, farther in the bay, the same point may be brought North (by compass) a little easterly, when the northernmost of two northern points will appear about a ship's length open, without the southernmost; and the high castle of the town S.E. by E. or S.E.; the depths 16 to 18 fathoms, fine gray sand. There is also anchorage within, in 15 fathoms, with the North Point N.N.W. or N. by W.; but these are the summer roads: in the winter, you must anchor farther from the land, in 20 or 22 fathoms, as already shown. You may boldly run in to the summer roads by night, with the castle bearing E. by S. or East.

If bound to Saffi, from the northward, shape such a course as will lead sufficiently to the westward of Cape Cantin, in order to avoid the rocks about that cape. You may easily know on which side of Saffi you are standing, as the land to the northward of the bay is high and uneven, and that to the southward of it is a plain, even land.

From the South point of Saffi Bay, which is very low, to the mouth of the *Wad Tansift*, or River of Marocco, the coast trends S.S.W. ¾ W. [*S.* ¾ W.] 16 miles, and presents, generally, a line of sand-hills, from 150 to 200 feet high, which, in some places, termi-

* *Ras al Hudik*—Cape of Palm Groves.

nate in low cliffs, and in others slope to the beach. Inland is a ridge of sandy looking hills, covered with brushwood, the highest 650 feet above the sea. There is a large tank on shore, nearly midway between Saffi and the Tansift, and on the southern bank of the river is an old castellated building, square and roofless, which was built for the use of travellers. The Bar of the Tansift, although a considerable river, is in summer entirely dry at low water.

MOGODOR.—From the Tansift the coast extends in the direction of S.W. by W. ¼ W. [*S.* 40° *W.*] to a low sandy point, forming a cove to the northward of it, with rocks within half a mile from the beach. The coast, which from the Tansift is barren and uncultivated, and from 200 to 300 feet in height, here assumes features of fertility. The lofty *Jibel Hadid*, or *Iron Mountains*, extending more than 20 miles, is a mass of high land, which here rises to the height of 2,350 feet; another, nearer the sea, with a conspicuous tomb on its summit, rises to 2,100 feet.

A sandy beach continues from the reef point nearly S.W. [*S.* 21° *W.*] 12 miles, to Mogodor; the inland prospect is here bounded by the *Botof* sand-hills, which extend parallel to the beach, at the distance of a mile.

SUERRAH or SUIRA, otherwise Mogodor, is the only port on this coast which maintains a regular commercial intercourse with Europe. Its population has been computed at 9,500 persons. The town is built on a low flat desert of accumulating sand, which separates it from the cultivated country, and is defended from the encroachment of the sea by rocks, which extend from the northern to the southern gate; though, at spring tides, it is almost surrounded by water. There are two towns, or rather a citadel and an outer town. Those Jews who are not foreign merchants are obliged to reside in the latter, which is walled in, and protected by batteries and cannon, as well as the citadel.

The wind being high all the summer, with little intermission, nothing grows here in sufficient quantity to supply the inhabitants; all kinds of fruits and vegetables are, therefore, brought from gardens 4 to 12 miles distant; and the cattle and poultry are also brought from the other side of the sandy hills, where the country, although interspersed with *Harushe*, or stony spots, is capable of producing every necessary of life. The insulated situation of the town, and other circumstances, deprive the inhabitants of all resource, excepting that of commerce, so that every individual of the place is supported directly or indirectly by it. In this respect, it differs from every other port of the coast.

An island, which lies to the S.W. of the town, forms the harbour. This island is about 1¼ miles in circumference; and between it and the main land, on the South, is the anchorage.* There are here, in some parts, only 12 feet at low water; therefore, large ships do not enter the port, but anchor at about 1¼ miles westward of the Skalla, or long battery, which extends along the West side of the town toward the sea.

On approaching the land in the parallel of Mogodor, the first remarkable feature which appears, is the craggy summit of Mount Atlas, covered with snow, and contrasting with the dark ridge of hills between it and the coast. To the northward, the *Jibel Hadid* appears insulated, and, as you draw nearer, a long patch of sand becomes visible; and finally, the white towers of Mogodor rise, as it were from the water. Soundings, in 100 fathoms, may be found at 23 miles from shore, when the water immediately becomes discoloured; the soundings decrease very gradually, over a bottom of sand.

Mogodor has a beautiful appearance at a distance from the sea; the houses being all of stone, and white. The streets are, nevertheless, narrow and dull. A winter seldom passes but some ships are driven ashore by the S.W. winds; and this happens generally between the 8th of December and the 18th of January, the season called *Liali* by the Arabs, and the only period dangerous for shipping in the bay.

Lieutenant Arlett says, that, of the inhabitants of Mogodor, in 1835, 4,000 were Jews, separated by a wall from the quarter of the Moors, whose portion is called the *Citadel.* All laborious work is performed by Jews, and domestic servants are all of that class. Much of the trade is also monopolized by the same people; for, owing to certain exemptions from duty, they are enabled to undersell European traders.

The principal exports are wool, gum, wax, hides, skins, almonds, honey, ostrich feathers, and gold dust. *Imports*,—iron, hardwares, and cotton goods. Duties fixed and

* See the Survey of the Bay and Town, by Sir W. Sidney Smith, on the Chart of the Coasts from Gibraltar to Cape Blanco, published by Mr. Laurie.

not very heavy. The want of water has been diminished, by the construction of an aqueduct, which conveys the stream from the river, 1½ miles distant, to several large tanks in different parts of the town. One of these is exceedingly convenient for vessels watering, being close to a jetty, inside a fortified bridge, which connects an islet with the main; here boats may fill, toward high water, perfectly sheltered from all winds. The market is excellent; provisions of all sorts, including fish, poultry, and game, are abundant and cheap; as are, also, fruit and vegetables.

The position of the British consul's house, as given by Lieutenant Arlett, is 21° 30′ 29″ N., and 9° 46′ 0″ W. Captain Boteler makes the longitude 9° 44′. From the roof of this house, the highest snowy peak of Atlas is seen, bearing S. 45° E.*

The roadstead, during the winter, can scarcely be considered tenable; and even in the summer, the strong N.E. winds which prevail cause a very disagreeable sea. A westerly wind throws a very heavy swell into the harbour; but, notwithstanding reports which prevail to the contrary, it is not generally unsafe for vessels properly found in cables and anchors.

The North Passage into the Harbour is between the town and island. A great ledge of rocks extends from the main, among which those next to the island stand high above water. In coming from the northward, if you would sail in behind the island, you must run between it and those rocks, close by them, where you will have 5 fathoms of water. The best anchorage is under the island, in 2½ fathoms, as there the ground is good.

South Passage.—A small reef extends from the South end of the island, toward the main land; and, on the South side of the passage, a bank extends from the main land to a considerable distance. In sailing outward, run along by the latter, and you will soon be in 4, and thence to 10, fathoms of water. The tide flows here, on the full and change, at 4ʰ, and rises from 10 to 12 feet. The current is scarcely preceptible.

Mr. Judah Paddock, in the Narrative of his Wreck and Captivity, in the year 1800, which is more particularly noticed hereafter, has made some useful remarks on the Port of Mogodor; and he says, that the regulation of the police, with respect to the market there, is a matter worthy of notice. Every morning an officer goes to each stall, and pastes up a piece of paper, upon which is written what is to be the price of beef for that day. So severe is this regulation, that no seller dares to exceed that fixed price; though every one is at liberty to sell as much below it as he pleases. Thus much trouble is saved, and no imposition can be practised on the buyer, as the meat is rarely sold below the fixed price. The price of the meat is governed by the price of cattle which are constantly for sale without the gates, and are always cheap.

The exportation of horses was utterly forbidden; but mules, asses, and horned cattle, were permitted to be exported, after a payment of a specific duty, similar to that laid on the other productions of the country.

"The Impost was under a peculiar regulation, very agreeable to the mercantile houses, which was this: when a ship arrived, a report of her cargo was made; there were no custom-house forms, no bonds entered into for the emperor's dues, but the goods were all landed, and put into his stores. One-tenth was then taken by the emperor's officers, and the remainder was given up to the merchant, who took it away at pleasure. Articles, however, that were not used by the Mooselmin, such as ardent spirits, wine, &c., were subject to a particular duty, which, being paid, those articles, like the rest, were suffered to be taken away from the royal stores. The merchants in Mogodor had but very little trouble in making this division between the government and themselves; for their correspondents, if made acquainted with this resolution, would, in shipping goods, have them packed in *tenths;* for instance, ten pieces in every package of cloth, so that when the goods were all stored, it would require little time or trouble to divide them according to law. Smuggling was very rare. The guards at the city gate were so diligent, that any clandestine management could readily be detected.

"Duties on exports were paid at the city gate in the following manner:—A merchant intending to ship a quantity of goods, goats' skins, for instance, informs the governor of his intention, and requests him to be at the gate on a given time of the next day. The governor attends in person, accompanied by a scribe, and a servant following with a mat for him to sit on. He looks at the bundles and counts them, points out a few which he

* See Captain Washington's note upon this particular, in the *Journal of the Royal Geographical Society*, vol. vi. p. 291.

orders to be opened and counted, and on being satisfied as to the number of skins in each, the scribe calculates the sum that he should receive as government dues. On his demand it is counted out to him, by the merchant, who previously knew the exact amount. The scribe counts again, and informs the governor if he be correct, who then gives permission to ship the articles, and returns with the scribe and his servant. I frequently thought, while I was in Mogodor, that, of all the parts I had visited, none was nearly equal to this for doing business, relating to imports and exports, with ease and correctness."

At the distance of about 2 miles inland from Mogodor is the *Commerce Garden*, an agreeable place of resort for the European residents and strangers, and which has the advantage of a fresh-water rivulet running through it. This place, Mr. Paddock says, was presented to the merchants of Mogodor by one of the emperors (shareefs), and it contained, besides vegetables, some trees and shrubs affording a little fruit. "The dreariness of the neighbouring country made this little spot delightful. There was a house in it, which, though a small one, was sufficiently large to accommodate a large party, who commonly met about noon to partake of a cold dinner, and returned home toward evening. From what I discovered among my friends, these convivial assemblies were productive of some good. The English and French were then at war, but the subjects of both these great nations joined in these parties in the garden, as well as other convivial meetings; and during the nine weeks that I frequented this mixed company, I never heard one political subject discussed. Consul *Gevin* told me, that each party showed the same desire, in company, to avoid every observation on the subject of home concerns, which related to the contentions between the two governments."

FROM MOGODOR *southward*.—At 8¼ miles S.W. from Mogodor lies *Ras Tagrifelt*, or *Cape Sem*, a low sandy point, sloping gradually from the height of 490 feet, and terminating in a reef of rocks which extend, on all sides, to the distance of rather more than two-thirds of a mile. The coast between this and Mogodor is a continuous line of bare sand-hills, 70 feet high, and sloping to the beach. In the background are the *Botof* sand-hills, covered with a dark evergreen. Under the cape is said to be a rocky bank, stretching 2 leagues off, and upon which, at a league from shore, has been found 13 fathoms; at 2 leagues, 20 fathoms, rocky ground; at 3 or 4 leagues, 35 and 40 fathoms, oozy sand. Hereabout the current sets violently to the southward.

CAPE TEFELNEH.—CAPE TEFELNEH, at 18¼ miles S.S.W. from Cape Sem, rises to the height of 780 feet, and terminates in a point from which a ledge of rocks extends half a mile, with deep water close to them. There is anchoring ground under it, on the South, affording shelter from East and N.E. winds, in 10 fathoms, sand. At 8 miles to the northward of Cape Tefelneh is *Kuleihat*, a small village on the side of a wooded hill. A little stream, *Tidsi*, falls into the sea at its foot, through a picturesque ravine: between these, high cliffs, apparently of sandstone, face the sea.

CAPE GHIR, or GEER (properly *Ras Aferni*), is situate, according to Lieutenant Arlett, in lat. 30° 37′ 30″, and lon. 9° 52′ 30″, and projects boldly into the sea at 25 miles to the southward from Cape Tefelneh. The intermediate back land rises to the height of 2,895 feet above the sea: the country appears wooded, and numerous villages and tombs may be seen. On approaching Cape Ghir from the westward, it presents a bold bluff slope on each side, the highest part 1,235 feet above the sea. The depths of water gradually diminish, and soundings are found at 26 miles off. The coast between Cape Tefelneh and Cape Ghir is a sandy beach. *Cape Ghir* is very remarkable, and may be seen when 4 leagues off. To the northward of the cape, about 4 miles within land, stands a round hummock, which is a mark for the cape, and the land farther to the northward is still higher; but on approaching the cape no land will be seen to the southward of it. From the North side of the cape, a reef extends to some distance out to sea, and should not be approached nearer than in 20 fathoms of water.

AGADIER, or SANTA CRUZ.—*The Town of Agadier*, or *Santa Cruz*, stands at 6 leagues south-eastward of Cape Ghir, at the bottom of the bay of the same name. This is the last port of Marocco on the Atlantic Ocean. The town, which stands on the summit of a mountain, is strong by nature, and its walls are defended by batteries; but the principal battery is at a short distance from the town, down the mountain, and was originally intended to protect a fine spring of fresh water, close to the sea. This battery also commands the approach to the town, both from the North and South, and the shipping in the bay. The ruins of the town, called by the Portuguese *Fonté*, remain at the foot of the mountain; and the arms of that nation are yet to be seen in a building erected over the spring.

The bay is considered as the best road for vessels on the coast of Marocco, being large and well sheltered. It abounds in fish, immense quantities of which are caught by the inhabitants of the town, and prepared in ovens for transportation to the interior. Owing to the jealousy of its government, Agadier has ceased to be a place of trade; yet it was formerly the centre of a very extensive commerce, whither the Arabs, and the people of Soudan, resorted to purchase merchandise, for the markets of the interior of Africa; and caravans were constantly passing to and from Timbuctoo.

From the northward high barren hills slope to the beach, which is rocky, to the distance of 5 miles N.W. of Agadier, where a streamlet, the *Wad Tamarect*, flowing through a green valley, discharges itself into the sea. The high land, extending from Cape Ghir to Agadier, usually called the *Heights of Idautenau*, is the western extremity of the main chain of the Atlas, which ranges hence in an E.N.E. direction, and rises, at 9 miles eastward of Agadier, to the height of 4,408 feet, and a remarkable conical hill, 3,980 feet.

At 6 or 7 miles to the N.W. of Agadier, above a point stretching into the bay, is a good anchoring place, with from 20 to 12 fathoms. In sailing from the cape to the road, be sure to run along by the land of the cape till you are before the castle, because northerly winds are very prevalent here; and should you keep too far from shore, you may be forced to fetch it up again with difficulty. If coming in by night, approach no nearer than in 12 or 14 fathoms.

To anchor in the Road of Agadier, enter the bay so far that the castle may bear N.N.E., and the storehouses E.N.E. Here you will be to the southward of a rocky ledge, lying off the town, in 7 or 8 fathoms of water. The best riding is with Cape Ghir bearing North, in 6 or 7 fathoms. Care must be taken to have your anchors ready; your small bower is always to be laid out before the land-wind, and the others to seaward; the sheet-anchor must also be in readiness, and brought out to the S.W. against a storm, which is soon perceived by the rising and swelling of the sea. It is likewise necessary to keep the foresail to the yard, that you may defend yourself the better, should you happen to be driven from your anchors.

On the Coast of Suse, southward of Agadier, there is no port frequented by shipping; but Mr. Jackson has emphatically stated, that "there is a track of coast which holds out great encouragement to commercial enterprise, and secure establishments might be effected upon it, which would amply remunerate the enterprising speculator. The people of Suse are, also, well disposed towards Europeans, particularly the English; and the communication and short distance between this place and the provinces, or districts, where most of the valuable products of Barbary are raised, render it peculiarly adapted to trade." From Agadier southward, the authority of Marocco lessens, and the Wedinoons proudly boast their independence. This capability for European enterprise led to the project of the Zahara Suz Company for developing its commerce.

Immediately to the southward of Agadier a very low and flat country commences, and extends thence 29 miles. At 5 miles to the southward of Agadier is the mouth of the *Suse*, a fine river, rising at the base of the Atlas; but the bar is dry at low water, and can never be passed by vessels drawing more than 4 or 5 feet. From the Suse the coast southward continues sandy. The *Wad Messa*, about 30 miles from the Suse, has, likewise, a bar dry at low water, but may have 4 or 5 feet over it at high water, spring tides. At a short distance within this, on the North side, is a village; and near the beach, on the South, a castellated building.

At a few miles to the northward of the Messa are the wells called *Tomie*, or the Seven Wells, off which is an open roadstead. On this parallel, about 30° 0′, is a depth of 86 fathoms, dark sand, at 16 miles from shore; and 45 fathoms, sand and mud, at 5 miles from the same, decreasing thence gradually to the beach.

Cape Aguluh of the charts is only a slight rounding of the coast, in lat. 29° 49′, lon. 9° 48′.* From the Messa southward the beach still continues sandy, but verdant hills, approaching the sea, break off into cliffs, apparently of sandstone, about 100 feet in height. In the interior is a ridge of high mountains, at 50 or 60 miles from the coast. The interval between appears like a wooded and well-cultivated country, with many houses and farm buildings. Immediately to the southward of the cape is a little sandy bay,

* Where the Messa has commonly been represented. The latter, we presume, is in lat. 29° 56′, or thereabout.—Ed.

and a valley crossed by a hill on which stands the village of Aguluh. A small stream runs down the valley. The slopes of the hills were waving with corn, nearly ripe, in May, 1835.

At 12 miles to the southward of Aguluh, the features of the country change; the hills become barren and abrupt, and form in successive ridges, gradually increasing in height till they join the line of distant mountains, which rise to the height of nearly 4,000 feet, and appear to be the S.W. extremity of an off-set of the Atlas. More to the southward the appearance of the inland country continues the same, but the coast changes to dark red cliffs, broken into coves, on the beaches of which boats may be seen; and there are many villages, but inhabited by people of perfidious character.

In lat. 29° 22′ is a remarkable white cliff, supposed to be of limestone, and described by Lieutenant Arlett as follows:—Its strata are extremely curved and irregular, and it forms a good mark for the coast: behind it, and standing alone, is a conical shaped mountain, rising to the height of 3,906 feet. In this latitude, at 25 miles from shore, are soundings in 105 fathoms, broken shells: outside of this the bank drops very suddenly. On standing in-shore the soundings decrease rapidly to 60 fathoms. At 5 miles from shore are 28 fathoms, coarse sand; the depth thence decreases very gradually to the beach. From the cliff above described the country assumes a more rugged and barren appearance; the hills steep, with deep and narrow ravines; the coast, alternate hills and sandy bays, with prominences rocky and rugged.

In 29° 10′ N. is a cove, marked on the charts *Reguala* or *Gueder*. A rocky prominence on each side projects to a short distance; the sides are steep and barren; these are separated by a deep and narrow ravine, down which a slender stream finds its way to the sea. In this cove the water is deep, and bottom clean to the beach; a landing may generally be effected in it, but it affords no shelter.

In lat. 29° 3′ the mountainous country terminates, and a sandy desert commences. There is also a break in the coast, which seems to be the dry bed of a river, and is called by the Canarians *Rio de Playa Blanca*, or White Beach River. At 4 miles to the southward of this the coast is of bold sandstone cliffs, with sand-downs in the interior devoid of herbage, and thus it continues to Cape Noon, in lat. 28° 45′ 45″, as shown in page 48.

CAPE NOON presents a cliff of sandstone 170 feet above the sea; but, owing to the cliffs, to some distance on each side, being of the same height, and the country inland a flat desert, it is difficult to make out the exact projection till very near it. The cape is steep-to, and clear of danger.

Here the depth gradually increases outward; and at the distance of 4 miles from shore the depths are from 30 to 54 fathoms, bottom of reddish sand; at 12 miles, 57 fathoms, dark sand; and at 30 miles, 98 fathoms, coarse red sand; the water then deepens very suddenly. For a long distance, both to the northward and southward of the cape, as well as to seaward, the water is very much discoloured. It has a red tinge, and is so thick that the track of a ship is visible for a length of time.* At 4 miles to the south-westward of Cape Noon is the *River Shleema* (the Akassa of the charts); and at 31 miles more, in the same direction, is the Akassa, in lat. 28° 19′. (This must be the Inoon of the Chevalier de Borda, given in page 48.) Each river has a bar, but both appear to have deep water inside, and the banks of both are verdant and fringed with shrubs.

The Shlēema, when well open, may be recognised by two remarkable hills, which will then appear in the centre of the gap: they are conical; and on one of them, 325 feet high, are some ruins, said to be those of a fortress. The coast between Cape Noon and the Shleema affords secure anchorage, with moderate depth of water, from the month of March to October.

WEDINOON, or NOON, is a kind of intermediate depôt for merchandise on its way to Soudan, and for the produce of Soudan going to Mogodor. Gums and wax are produced here in abundance; and the people, being independent, indulge in the luxuries of dress, and use many European commodities. A great quantity of gold-dust is bought and sold here. They sometimes trade to Mogodor, but prefer selling their merchandise on the spot, being unwilling to trust their persons and property within the territory of Marocco. With Timbuctoo, however, they carry on a constant and advantageous trade,

* This discoloration is attributed, chiefly, to the vast quantities of sand blown from the desert.

and many are immensely rich. They also supply the Moors of Marocco with convoys through the desert to Timbuctoo.*

The coast line between the Shleema and Akassa (or Inoon) is a continued sandstone cliff. A table-land, about 900 feet high, at 3 miles from the shore, shows just above the cliffs, near which there is a regular depth of 20 fathoms, with good ground. On approaching, the table-land appears to break into detached hills, one of which, 950 feet high, and more insulated than the others, serves to identify the river.

The FISHERY carried on by the people of the Canaries commences near the parallel of Cape Noon, the fishermen seldom venturing to the northward, although fish are equally abundant, from their dread of the Moors, who, on that part of the coast, possess boats. From the cape to the Bank of Arguin (an extent of 200 leagues) the inhabitants of the desert have not a single boat. The fishermen frequently land, not only to procure water, but to barter their fish for wood and orchilla; on these occasions great precautions are taken, as atrocities have frequently been perpetrated on both sides.

From the River Akassa (Inoon of Borda?) the coast and country continue as described above. The cliffs are above 120 feet in height to lat. 28° 7′, or the Porto Cansado of the charts. Here the cliffs terminate, and a low sandy beach begins, continuing in a S.W. direction 18 miles, to lat. 28° 2′, lon. 12° 14′, where there is the entrance of the *Porto Cansado* of the Portuguese, which is described in the Narrative of Judah Paddock, as given hereafter. The entrance of this harbour is narrow, widening inside, and forming a sort of lagoon. The sea breaks heavily across, and, at times, it is barely possible that boats may enter. Its only distinguishing mark is a table hill, 580 feet high above the sea.

Nothing can be conceived more dismal than the appearance of the shore hereabout. For many miles not a dark spot is to be seen to break the monotonous appearance of the sand; the fine particles of which, mingling with the haze occasioned by the heavy surf, render the coast very indistinct.

From Porto Cansado the coast trends westward to *Cape Juby*, in 12° 55′ W. At a short distance to the westward of Porto Cansado, a cliff, from 90 to 100 feet in height, again commences, and continues for 17 miles. The cliff is of dark sandstone, and the bottom, being also of dark sand, gives a green appearance to the water. A flat desert extends inland as far as the eye can reach. There is no beach, the sea breaking against the cliffs, on which it appears to be encroaching. Where the cliffs terminate, the land becomes broken into sand-hills partly covered with bushes, and the coast trends in a *true* direction S. 80° W. to Cape Juby, 15 or 16 miles.

Cape Juby is a low sandy point; near its extremity is a hummock, covered with bushes, appearing like an islet. Rocks extend from the cape to one-third of a mile. Here the coast changes abruptly to S.W. (*true*), and forms some coves, off the points of which are scattered rocks. From Cape Noon to Cape Juby the bank of soundings extends to an equal distance, and the depth increases very gradually to the shore.

CURRENTS ALONG-SHORE, BETWEEN CAPE SPARTEL AND CAPE BOJADOR.

During five months (from March to August), the time occupied by the *Ætna* and *Raven*, in the survey of the coast, a distance of 750 miles, no day passed in which the former was not at least twelve hours at anchor, usually at the distance of from 4 to 5 miles from shore, and in positions well adapted for making observations on the currents, which were constantly attended to. Independently of this the *Raven* was repeatedly sent to the distance of 20 and 30 miles from land; particularly when fixed and conspicuous objects afforded opportunities for ascertaining her exact position; by comparing which with that which should have been given by the course steered, the rate and direction of the current could be ascertained to a considerable degree of exactness.

From Cape Spartel, along the coast, to Arzilla, and also to the distance of 7 or 8 miles from the shore, a regular tide was experienced, running parallel to the coast; but its strength was rather greater to the northward than to the southward. In this distance, at 15 miles from land, no tide or current was perceptible.

* To those who wish for further information on this subject, we recommend the valuable work by Mr. Jackson, already quoted. See, also, *Journal of the R. Geog. Soc.*, vol. vi. p. 297.

"From Arzilla, southerly, a tide was still experienced, gradually diminishing in strength till its direction could not be ascertained. From the parallel of 34° 30′ N. to the distance of 20 miles in the offing, a steady southerly set was first experienced. This current, in the offing, continues invariably to follow the direction of the land; its velocity increasing or diminishing from the rate of four-tenths to 1 mile an hour, according to the strength or continuance of the north-easterly winds.

"From Mogodor to Cape Bojador, except in particular instances, the current continues invariably to run in the direction of the coast. Its greatest strength is usually at the distance of from 3 to 6 miles from the land, gradually decreasing on receding from it. Its average rate between 31½° to 28° N. is from one-half to three-quarters of a mile in the hour. At Cape Juby, probably from its stream being in some measure confined by the projecting cape, and perhaps by the Canary Islands (distant 58 miles), it increases its rate to 1¼ miles, but diminishes off Cape Bojador to 1 mile. It did not appear that this current was influenced by any particular wind, but near the shore a tide was generally perceived."

Description, &c., continued.—The various tribes of Arabs, frequenting the coast of the desert, have already been alluded to, as well as the danger of falling into their power. Their practice has been, when a ship is stranded, and the crew compelled to surrender, to take everything portable from the vessel in boats; and then, if the sea do not dash it in pieces, they set fire to it, that it may not serve as a warning to other ships which may be so unfortunate as to follow the same course.

Mr. Jackson has communicated a stratagem by which a ship was, many years ago, saved on this coast. The vessel was stranded, and one of the crew being a Spaniard, who had been used to fish there from the Canaries, advised the captain to let go an anchor, as if the vessel were riding, and in safety. Some Arabs coming on board, the captain told them to bring their gums and other produce, for that they were come to trade with them, and were going away again in a few days. As it happened to be low water, the vessel, on the return of the tide, floated: they then weighed anchor, and set sail, to the great disappointment of the people on shore.

Of the vessels wrecked, from time to time, on the coast of the desert, many are probably never heard of; and, if any of the crew survive their hardships, they are induced, seeing no prospect of emancipation, to become Mohammedans, and nothing is afterward known or heard of them: the vessel is supposed to have foundered at sea, and all passes into oblivion.

It has been stated, that there were about thirty vessels, of different nations, the greater part English, lost on this coast between 1790 and 1806, part of whose crews found their way to Marocco, and gave some account of their catastrophe; of the remainder, a number were subsequently ransomed; but the majority were either lost, or dispersed in various parts of the desert, after a lapse of time, in consequence of the consul's making no offers sufficiently advantageous to induce the Arabs to bring them to Mogodor.

Upon this subject we find the following passages in *Mons. Golberry's Travels in Africa:*—"These Moors undertake very long journeys, crossing the deserts in every direction. On the banks of the Senegal and Niger they make prisoners of straggling or shipwrecked individuals, whom they convey toward the Mediterranean, and sell for slaves.

"The tribes of Moors who constantly trade with us in the Senegal are three in number, distinguished by the names of *Trarshaz* (Tarassas of *Jackson*, or Trazars), *Brackknaz*, and *Woled el Haghi*, or *Darmanko*.

"Discontented individuals of these three tribes have formed themselves into a horde, who live by pillage and rapine. They traverse the coasts from the Senegal to Cape Bojador, and make a trade of watching for shipwrecks; their spies, who are dispersed along the coast to the distance of more than 100 leagues, correspond with each other by means of signals: and when a vessel, which they often lead astray by perfidious marks, imprudently approaches land, and runs aground, these savages immediately plunder it, seize on the unfortunate crew, make them captives, and treat them with disgusting barbarity; or else they sell them to the neighbouring hordes, by whom they are conveyed, in a state of slavery, to Marocco.

"This horde is designated the *tribe of thieves*, and do not blush at this odious denomination.

"The administration of the Senegal made annual presents to the chief of this banditti, whose rendezvous was in the oasis of Gualata, to induce them to save individuals wrecked on the coasts, and bring them to the Isle of St. Louis. For each slave made in this way, it is added, the English gave a bounty of ten guineas."

WRECK OF THE SHIP CHARLES, 1810.—In the year 1816 was published, "The Narrative of Robert Adams, a sailor, who was wrecked on the western coast of Africa, in the year 1810; was detained three years in slavery by the Arabs of the Great Desert, and resided several months in the city of Timbuctoo. With a map, notes, and an appendix:" 4to.

From this work we learn, that the American ship *Charles*, John Horton, master, sailed from New York on the 17th June, 1810, being laden with flour, rice, and salted provisions, and bound to Gibraltar. In twenty-six days the vessel arrived at that place, where the cargo was discharged. She lay at Gibraltar about a month; and, after taking in sand-ballast, sixty-eight pipes of wine, some blue nankeens, and old iron, proceeded on her voyage, the captain stating that he was bound to the Isle of May for salt; but afterward it appeared that he was going on a trading voyage down the coast. When they had been at sea about three weeks, Adams heard two of the crew, who were old sailors, and who had been on the coast before, speaking to the mate, stating their opinion that the captain did not know where he was steering: the advice was disregarded, and they had to beat against contrary winds for eight or nine days afterward; and on the 11th of October, about three o'clock in the morning, they heard the breakers; when Matthews, the man at the helm, told the mate, who was keeping watch, that he was sure they were near the shore; to which the mate replied that "he had better mind the helm, or his wages would be stopped." An hour afterward, the vessel struck; but there was so much fog that the shore could not be seen. The boat was immediately hoisted out, and the mate, with three seamen, got into it; but it instantly swamped. The four persons who were in it swam, or were cast ashore by the surf; soon after the sea washed off four or five more of the crew, including Adams; but, as most of the ship's company could swim, they all reached the shore. When morning came, it appeared that the ship had struck on a reef of rocks, extending about three-quarters of a mile into the sea, and were more than 12 feet above the surface at low water. The place, according to the captain's reckoning, was about 400 miles to the northward of Senegal. Soon after break of day, they were surrounded by thirty or forty Moors, who were engaged in fishing on the coast, by whom Captain Horton and the ship's company were made prisoners. The vessel bilged, the cargo was almost entirely lost; and what remained of the wreck was burnt by the Moors, for the copper bolts and sheating; but, as they had no tools wherewith to take off the copper, they saved little more than the bolts.

"The place, which was called *El Gazie*, was a low sandy beach, having no trees in sight, nor any verdure. There was no appearance of mountain or hill; nor (excepting only the rock on which the ship was wrecked) anything but sand as far as the eye could reach. The Moors were straight-haired, but quite black; their dress consisted of little more than a rug or skin round their waist, their upper parts, and from their knees downward, being wholly naked. The men had neither shoes nor hats, but wore their hair very long: the women had a little dirty rag round their heads, by way of turban. They were living in tents, made of stuff like a coarse blanket or goats' hair and sheep's wool interwoven; but some of them were without tents, until they made them of the sails of the ship; out of which they also made themselves clothes.

"The Moors stripped all the crew naked; and their skins, by being exposed to a scorching sun, were dreadfully blistered. The captain was soon taken ill; and having been provoked to show somewhat of violence toward the Moors, they seized and murdered him. After remaining at El Gazie ten or twelve days, the Moors prepared to depart, and divided the prisoners among them. Adams, Dolbie (the mate), and Newsham (a seaman), fell to the share of about twenty Moors, who quitted the coast, with four camels laden with water, fish, and baggage. They travelled on foot, at the rate of 15 miles a day, in an easterly direction, and in thirty days arrived at a place containing thirty or forty tents, where they found a pool of water surrounded by a few shrubs, which was the only water they had met with since quitting the coast."

The subsequent adventures of Adams, &c., are irrelevant to our purpose. We, therefore, only add, that he was ultimately sold at Wedinoon, and was ransomed thence by Mr. Joseph Dupuis, the British consul at Mogodor. Being unwilling to come to Eng-

land, Mr. Dupuis sent him to Tangier, whence he passed over to Cadiz, where he arrived on the 17th of May, 1814, making three years and seven months since he was wrecked. Circumstances afterward brought him to London, and the result has been the narrative, by Mr. Simon Cock, to which we owe our knowledge of these facts.

WRECK OF THE BRIG COMMERCE, 1815.—"The American brig *Commerce*, Jas. Riley, master, sailed from Gibraltar, for the Cape Verde Islands, on the 23rd of August, 1815. Soon after the vessel had left Cape Spartel, the weather became so foggy that scarcely any observations could be taken; and to this cause are referred the errors in the reckoning which produced the loss of the vessel. Some doubts arising in the mind of the master, when, by the log, he judged himself to be about 30 miles North of Cape Boiador, he was induced to determine hauling off to the N.W.; but before his orders could be executed, breakers were heard under the lee. He, in vain, attempted to stand off; the vessel was carried by a current and the sea directly toward the breakers; she, consequently, took the ground: surge after surge came on, and she was driven, notwithstanding anchors, which had been let go, partly with her head on shore, where she struck with such violence as to start every man from the deck. It afterward proved that the scene of this calamity was near Cape Boiador, and there can be little doubt that the brig had been carried to the southward by the current. As the vessel soon began to fill with water, and seemed in momentary danger of going to pieces, the long-boat was quickly hoisted out; some of the articles, most valuable under present circumstances, were placed in it, and the crew, with difficulty, reached the shore. They had scarcely landed, and began to secure their effects from the sea, when a human figure, whose complexion was between that of a negro and an American Indian, made his appearance: his form and face are described as hideous. Some women and children soon joined him; and feeling themselves strong, they commenced an indiscriminate plunder. Riley and his crew had no fire-arms, but might have defended their property with pikes, had they not been afraid of irritating these people, of whose numbers, in the vicinity, they were uninformed. Such, however, was the effect produced on them by this visit, that they determined to regain the wreck in their shattered boat; which, after the departure of the savages, they reached with great exertions and continual bailing. Thence they saw the plunder of their effects continued on the shore, and all the articles which the Arabs did not want were consumed by fire. Riley was afterward tempted to venture again to land by a show of friendship in the natives; and, having accomplished it by means of the hawser, he was there detained as a hostage while the old Arab went to the wreck; but the latter, not finding in the vessel any of the objects of his search, soon returned to the shore.

"Mr. Riley was now in a most critical situation, and was menaced with instant death unless a treasure of dollars was produced from the wreck. As the noise of the surf prevented his voice from being heard by the crew, he partially made himself understood by signs, and some dollars were accordingly pushed in by means of the hawser. This booty did not act, however, as it was expected, in the way of ransom, and the captain had recourse to another device, more crafty than honourable. He had on board an old man, Antonio Michel (not enumerated in the list of the crew), who, by signs from Riley, was sent on shore: and, when he arrived, he was employed by his master to point out some spots in the sand where various articles had been buried on their first landing. This fixed the attention of the Arabs, and, during the process, Riley found means to throw himself into the sea, and regain the boat, which was alongside the wreck. On the discovery of his departure, poor Michel instantly fell a victim to the fury of the natives.

"The boat was now the only resource for the unfortunate crew, and to that they committed themselves and all their hopes; putting to sea in this leaky conveyance, with two of their number continually baling out the water. At last, their provisions failing, and the leaks increasing to a considerable degree, they were persuaded by their captain to steer for land; which they reached with difficulty on the 7th of September, at a promontory, as they afterward found, a little to the North of Cape Blanco. They were compelled to pass the first night on the beach, as they could discover no part of the rock that afforded the possibility of an ascent, and, when they did gain the summit, at some few miles' distance, on the following day, they beheld before them an endless plain, 'without a tree, shrub, or spear of grass, that could give the smallest relief to expiring nature.' The shock which they thus experienced is forcibly described. Toward the evening, when they were almost fainting with thirst, a light was perceived; and such were their present necessities, that when they discovered whence it proceeded, they were willing to accept slavery under the Arabs in the desert, in exchange for the hope of life, and a drop of

water to moisten their burning tongues. They did not, however, surrender themselves during the night; but the Arabs observed them, when at some distance, in the morning, and ran toward them; when the captain, taking Mr. Williams and Mr. Savage, his mates, with him, went forward to meet them, bowing himself to the ground before them, and, with signs, imploring their compassion. The prize of so many Christian slaves caused no small contention among the natives; and, after the captives had been all stripped to the skin, each Arab claimed those as his property whose dress he had allotted to himself. A battle, by no means bloodless, but not terminating fatally, ensued; and it was at length decided, by the arbitration of the scimitar, that Riley and Savage, with three others, should remain with one party, while the rest, mounted on the bare backs of camels, were carried in a different direction by another. Of the latter no more is known, other than that Porter, one of them, was afterward ransomed and brought to Mogodor, and that intelligence had been received of three of his companions.

"Although Riley's companions remained with one division of the Arabs, they were the property of different masters, and with them they proceeded into the desert: still naked, nearly starved, excoriated in a dreadful degree by riding in that state on the hard backs of camels, blistered over the whole body with the intense heat of the sun, and when obliged to drive the camels, their feet were cut nearly to the bone by stones almost as sharp as gunflints. The description of their sufferings, indeed, exceeds anything of a similar nature, which we recollect to have read of. In this state they were driven forward with blows; and, as their masters were in great distress, from the failure of provisions and water, the captives were limited in their sustenance to such a degree as to render it wonderful that the vital spark could have been preserved. When they had proceeded to the S.E. for more than a week, they were compelled to return toward the sea by the want of water; and, during their whole journey, the abhorrence of the white men, expressed by the women, was such that they were never admitted to the tents at night, but were exposed to the hard and flinty ground, where the *luxury* of a bed of sand could not be procured, and the cold cut them to the quick.

"They had passed fourteen days in this calamitous state when they were met by two Arab merchants from Marocco, Sidi Hamet, and Seid, his brother. Riley persuaded the former, by repeated entreaties, partly by signs, and partly in the few words in the language of which he had become master, to purchase him, and convey him to Suerrah (Mogodor). A bargain was accordingly struck for the extent of the ransom, to be paid by a friend, whom Riley represented himself to have at the city; which he did in reliance on the humanity of any of the European consuls who might hear of his captivity. He was ultimately still further successful in inducing the two brothers to embark in the speculation of purchasing his comrades also, with the view of equal reward; but this was done with the exception of a black cook. In this situation the sufferings of the party, in some measure, were mitigated, but they were still dreadfully severe. Sidi, on many occasions, evinced a compassionate disposition, but his brother was a savage in every sense of the appellation. Mr. Riley continued about six weeks in this servitude, journeying to the North, in a line nearly parallel to the sea, and, in some places, near the shore; perpetually reminded, even by Sidi, of the forfeit of their lives, in case the expectations of their purchasers should not be realized. Several attempts were also made to intercept them or steal them away, by parties of the Arabs. On the 19th of October, they first arrived in the habitable country of Wedinoon, in Lower Suse, where Riley was supplied with some scraps of paper, on which he contrived to write a letter, addressed to the consuls of the English, French, Spanish, or American nations. Sidi Hamet went forward with the letter; and, after a suspense of eight days, an answer was returned by a Moor in the confidence of Mr. Willshire, the English consul, Sidi having been detained at Mogodor.

"The eighth day of my master's absence passed tediously away, when, after dark, we heard a trampling outside the walls; Seid went forth to learn its cause, and soon returned with Sidi Mohammed, followed by a well-looking Moor: they came directly to that part of the yard where we were sitting on the ground, trembling with apprehension and with cold. When they came near us, the Moor called out, and said in English, 'How-de-do, Capetan?' This raised me and all my men from the ground; I felt as if my heart was forcing its way up into my throat, and it entirely obstructed my breath. I eagerly seized his hand, and begged to know who he was, and what was my doom; and if Sidi Hamet had come back. He then asked me, in Spanish, if I spoke that language, and being answered in the affirmative, he informed me, in Spanish, that he came from Mogodor,

that my letter had been received by one of the best of men, an Englishman, who was my friend, and who had shed tears on reading my letter; and that he had paid the money to my master immediately, and had sent him (the Moor) off, without giving him scarcely a moment's time to take leave of his wife, and that he had been on his mule ever since he left Suerrah, travelling on as fast as possible, night and day. The anxiety of my companions, by this time, had arisen to such a pitch, that they broke in upon his story, on which I communicated to them the thrice welcome and happy intelligence, that we had a friend who would redeem us from slavery. Our souls were overwhelmed with joy, and yet we trembled with apprehension lest it might not be true; at this moment, however, the Moor handed me a letter: I broke it open: but my emotions were such, that it was impossible for me to read its contents."

The letter, which was read by Mr. Savage, realized all their hopes, and dispelled all their apprehensions. The consul had not hesitated to advance the money at his own risk; and, as well by his letter as by his subsequent reception of his fellow-Christians, he showed how completely he entered into the spirit as well as the profession of our faith. Everything that humanity could dictate was done for the miserable sufferers.*

WRECKS OF THE OSWEGO, MEDUSA, &c.—Soon after the appearance of Mr. Riley's publication, from which the above particulars have been abstracted, another and similar volume appeared, describing the shipwreck of the *Oswego*, Judah Paddock, master, on the African coast, to the eastward of the Canary Islands. In the month of January, 1800, this ship, of 260 tons, sailed from New York, for the port of Cork, with a crew of thirteen persons. Having performed this voyage, and discharged his cargo, the captain determined to ballast his vessel, go to the Cape Verde Islands, and take a load of salt, skins, &c., for New York. From ignorance of the current setting on this coast, it happened that, on the third of April, without *any particular stress of weather*, the vessel struck, during the night, on the coast of Barbary, somewhere near Cape Sabi, or between the parallels of 27° and 28°. It was the wish of the master to stay by the wreck, until preparations could have been made for a voyage in the long-boat; and it seems that such an attempt would have afforded a fair prospect of success; but his intentions were frustrated by the obstinacy of some of the crew; and the whole party went ashore in the boat without provisions or water.

From this time, the conduct of the crew, or at least a part of them, seems to have been highly censurable; and they were consequently captured by the Arabs, at a time when their means of escape appear to have advanced. They underwent the same species of suffering described by Captain Riley. The captivity took place on the 6th of April; and on the 27th of the same month the party had reached an inhabited and cultivated country, having many days of rest from travelling in the interval. A bargain was early struck with Ahomed, the chief of the tribe, for a price of ransom, on reaching Suerrah, or Mogodor; and they at length arrived at Agadier, or Santa Cruz, and thence, on the 16th of May, they came in sight of Suerrah, where the British consul did all that humanity could suggest, both for Mr. Paddock and his companions, and procured the release of him, and of those who had travelled with him, from the miseries of slavery.

It appears probable, from Captain Paddock's narrative, that the vessel had been set considerably to the eastward, before she reached the parallel of Cape Finisterre; but the great error, in her reckoning, unquestionably occurred subsequent thereto. In the parallel of Madeira it was, however, supposed that she was, or might be, to the *westward* of that island: but the vessel, according to observations for latitude, was generally ahead of her reckoning, and in the night of the 3rd of April she struck on the coast, as above mentioned, upon a reef of hideous rocks. With great difficulty the people landed, by crawling over slippery rocks to a sand-bed, "beyond which appeared a high hill, upwards of 100 feet in altitude." Captain Paddock says, "On the morning of the 4th of April, as soon as the day began to dawn, I ascended the high mountain of sand, and there remained till near sunrise. What could I see? A barren sand, without either tree or shrub, or the least appearance of vegetation; dreary in every respect; and, at a distance back, a long range of mountains extending East and West." It was next found, by a compass, that the shore extended nearly East and West; and, at 10 or 12 miles to the

* The volume, from which these particulars have been extracted, was published in London, 1817, at the price of 30s. It comprehends, however, an account of Timbuctoo, and much interesting information relative to the interior trade and condition of Africa.

westward, a cape projected into the sea, in form of a very square bluff. It seems that the captain had very inaccurate charts; he could not determine the place of the wreck, but supposes it near Cape Sabi, which we represent in 28° 10′ N.: and adds, "we must thus have been currented eastward more than 200 miles since speaking an English frigate off Cape Finisterre." The country in the vicinity of the wreck was wholly sandy, and at about 8 miles to the south-eastward had every appearance of once having been the bed of the sea.

On proceeding to the north-eastward the crew arrived at a fine sandy bay on the coast, which is probably the *Porto Cansado* of the Portuguese, as shown on our charts. It has 9 or 10 feet within a cable's length of the shore. The distance across it was estimated at about 3 miles: the two outer points are broad, closing to within 1 mile; a ledge of rocks on each point leaving a fair entrance of half a mile in breadth, with deep water. "Against those ledges the sea broke violently, but in the harbour it was smooth; from the windward side of the harbour a ship might lie very well, with the wind as it then was, which blew strong four points on shore, or at north-east. Had our situation been less deplorable, I should have been led to examine this fine-looking harbour more particularly. Should any national vessels ever undertake to survey this coast, they will, beyond doubt, visit it. From our judgment, being on shore, it would appear from the offing a nearly straight shore, as the two outer points, or chops, of the harbour would, except being near it, seem nearly to close on the western side of the harbour. Where we stood to look at it, the bank was high, and from sea-board would, in my opinion, appear like a high round knoll; the mountain back, only a few miles distant, would appear black, at least of a dark colour, and the top flat for several miles each way, running E.N.E. and W.S.W." On this nearly flat mountain, supposed to be nearly 400 feet in height, above the level of the sea, is a remarkable bed of salt, about a mile in diameter. Hundreds of ships can ride in the harbour in safety, defended from all winds except the north-west; and, as the entrance is so much narrower than the body of the harbour, no sea through that gut can hinder ships very much, the ground being perfectly clear.—(See *Remarks by Lieutenant Arlett, page* 335.)

Captain Paddock adds, "A survey of this coast, if done in the summer season, would neither be difficult nor attended with risk, provided there were employed two or three fast-sailing small vessels, furnished with good cables and anchors. There is a great number of anchoring places along the coast, at sea-board: and, although those situations are very rough, yet in that respect they are nothing in comparison to the anchorage on the Grand Bank; and, should a cable happen to part, or circumstances make it necessary to be cut, there would be no risk of going ashore; for, when I was on that coast, a vessel might be within two or three points of lying directly off shore. I learned from the Arabs that the Spanish fishermen frequently anchored near it, and by signs from them came ashore and traded with them, giving fish for skins, or for sheep's wool. In carrying on this trade, the plan they adopted for their own security, as Ahomed once related to me, was this:—'We approached,' he said, 'to the sea-side with our goods, and left one man with them, all the others returning back out of the reach of gun-shot. The Spaniards then landed, and made their agreement with this one man, he keeping himself so far from them as not to be within reach of their grasp, always ready for a start, and having full confidence in his heels.' Ahomed acknowledged that this trade was conducted fairly by the Spaniards. According to his representation, they often lay at anchor within a cable's length of the shore."

"Happy would it have been if, fifty years ago, a good survey of this coast had been made, and published to the world. A delineation of the very strong currents, especially, might have saved a number of fine ships, and a great many valuable lives. While I was in Mogodor I examined a great number of protests, made by masters, or other officers, upon oath, relating to ships that had been wrecked on that coast, and all of them attributed their losses to the currents that had swept them away, most of them to a great distance from the place where they had calculated their ships to be. *Not one of these ships was protested to be lost by stress of weather. Indeed, there is no doubt, in my own mind, that many missing ships, carried by the currents, along this inhospitable coast, have been wrecked, and never more heard of.* A vessel, in coming here, seldom meets with any shoal or rocks to strike on, till it strikes upon one of the many square and perpendicular bluffs, against which the sea beats with such violence that it must go to pieces in a very few minutes, and every soul inevitably perish. This circumstance, viewed in connexion with the great quantities of pieces of wrecks scattered along that coast, is sufficient, I

think, to support the opinion which I have advanced."—(*Paddock's Narrative, pp.* 19, 340-1-2.)

After the above was written, we received the affecting narrative of the loss of La Meduse, French frigate, on the Arguin Bank, to the southward of Cape Blanco, on the 2nd July, 1816; which may probably be attributed to a similar cause,—the direction of the currents. It has been justly observed, that the annals of naval distress do not offer a more terrible instance of shipwreck. *La Meduse* sailed, 17th June, 1816, from the Isle d'Aix, under the command of *M. de Chaumareys*, having on board 240 persons; of which the greater portion consisted of soldiers intended to garrison those forts, at the mouth of the Senegal, which had been restored by the treaty of peace; they were accompanied by the newly-appointed governor of that place.

The ship ran aground on the bank, in the parallel of 19° 36′. A great consternation ensued; and, after many angry deliberations, it was resolved, as they had only six boats on board, to break up the vessel, and with its material construct a raft large enough to place the soldiers on it, who were thus to be towed ashore.

On the 5th of July, the embarkation from the wreck took place, in the greatest confusion. One hundred and forty-seven persons (including the captain and surgeon) were confided to the raft. The precipitation with which it was built prevented its being fitted with railings. It was about 60 feet long; and if solidly put together, would have been able to bear two hundred men: but it was weak and ill-constructed, without sails or masts. There were placed upon it a number of quart measures of flour, five barrels of wine, and two casks of water.

" Scarcely had fifty men set foot on the raft, when it sunk at least 2 feet. To facilitate the embarkation of the rest, all the flour was thrown into the sea: the wine and water alone were preserved. With the whole number on board, the raft was sunk at least 3 feet, and so closely were they huddled together, that it was impossible to move a single step. Fore and aft the water was up to the middle of the unfortunate sufferers.

" It had been settled, that all the boats of the frigate were to tow us, and the officers who commanded had sworn that they would never abandon us. The boat in which the governor was, threw to us the first towing rope. If all the efforts of the boats had constantly acted upon us, favoured as we were by the sea-breeze, we should have reached land in less than three days, for the frigate was not wrecked more than 12 or 15 leagues from the shore."

By the boats, however, the raft was inhumanly abandoned: it was thus left to its fate amidst all the horrors of famine. In an element which already covered one-half of their bodies, the greater part of those upon it at once yielded to despair.

For twelve days this was the condition of the survivors; we say *survivors*, because, during this time, the number had rapidly diminished.

In the first night the wind freshened, and there was a considerable swell of the sea: the people tumbled over each other; and, in the morning, ten or twelve were found dead, with their lower extremities entangled in the interstices between the planks of the raft: others had been carried off by the sea. Day passed away, and a night succeeded more dreadful than the former; many perished. In the morning many others gave themselves up for lost, and fell to drinking until they had lost their reason. A mutiny ensued. The captain was thrown into the sea, but recovered by the officers and passengers. In the night, many soldiers appeared to be mad: a battle took place, and the morning discovered that sixty-five men had perished.

The recital thus describes the melancholy events of the twelve days; during which time, a principal portion of sustenance was derived from the bodies of deceased companions! At this period, only fifteen men remained, and these were happily discovered and taken off, on the 17th of July, by the *Argus*, French brig, which restored them to their country.

Another case is related by Captain Grover, in the *Geographical Journal*, vol. xvi., 1846, page 162. In this the brig *Courier* anchored near the Island of Arguin, and part of the crew were tempted to land, when they were immediately made prisoners with great violence and cruelty, and kept so for eleven months.

Other instances of ships lost upon this coast might be given; but those selected will be sufficient for our purpose.

CAPE BOIADOR TO CAPE BLANCO.—The tropical regions of the African *coast between* Cape Boiador and Cape Blanco, present to contemplation the *Sahara*,

considered as the most extensive desert on the globe. This desert consists of inadhesive sands, which are driven about by the winds, and chiefly by those from N.E., by which they are disturbed and carried to an astonishing distance. This circumstance has been noticed by Mr. Luccock, and we have met with other notices to the same effect in MS. Journals. Of the merchant-fleet from St. Helena, under convoy, in November, 1813, most of the ships had their sails covered with *red* sand, when they must have been from 400 to 500 miles from shore, in about 27° and 28° N., after a succession of easterly winds. "I once," says Mr. Luccock, "saw the sails and deck of a vessel covered with it, when 400 miles from the coast, and have heard of the same phenomenon being remarked at a far greater distance. This moving expanse of sand was, probably, at some anterior period, a large inland shallow sea, communicating with the Mediterranean by the Syrtes [Gulf of Sydra], &c.

A similar phenomenon occurred to the brig *Parssboro'*, on her voyage from Barbadoes to Belfast, and when she was upwards of 900 miles from the main land of Africa. The wind, it will be observed, had been at East, and was interrupted by one of those gales which will be noticed hereafter, in our description of the Azores. In lat. 23° 50′ N., lon. 32° 40′, Cape de Verde Island bearing S.E., distant 590 miles, the appearance of a heavy squall rising in the S.E. direction. Half-past six p.m., lightning, thunder, and the squall approaching nearer. At thirty minutes past six p.m., the sun, about 15° above the western horizon, became overcast with peculiar looking clouds, and every appearance of an approaching storm. I consequently shortened sail, although the barometer did not indicate anything serious. At eight p.m., the wind became very variable, from N.E. to S.W., every ten or fifteen minutes alternately, for two hours. There was a fall of rain when the heaviest of the squall was on the zenith. At midnight it had all passed to the S.W., and the wind resumed its former place, East. At daylight, *the decks, rigging, spars, and paint work were covered with mud*: and as the sun dried it, it had the appearance of a very fine red mould, with no sand in it.

Cape Boiador is represented by the *Chevalier de Borda*, in lat. 26° 12½′, but the late surveys exhibit it in 26° 7′ only. The cape has some rocks about it, but on its South side is a bay affording anchorage in 4 or 5 fathoms, and ships may anchor farther out in from 15 to 20 fathoms, within a league of the shore, on a bottom of sand, broken shells, &c.

The Baron Roussin says, that the coast to the northward of Cape Boiador is similar to that of the desert to which it belongs. It is arid and sandy, the only signs of vegetation being a few small tufts of dried brambles, scattered promiscuously here and there. It presents no other variety than some flat downs of a tabular form, whose base can scarcely be seen at the distance of 3 miles from the beach.' The nature of its soil is exclusively siliceous, being sand without any mixture whatever. The surface of this immense plain is so completely horizontal, that it actually appears to have been levelled. In some places on the coast it terminates in a steep cliff, and in others in a gentle descent toward the sea. These cliffs are streaked with horizontal beds of different shades, approaching to white; the lower ones being generally thinner, and of a more reddish cast than the upper. To the northward of the parallel of 23° N., this soil is overspread with a crust of black earth, which, from its being nearly general, may be taken as its covering, and is of a tolerable thickness. This species of crust, no doubt, derives its consistency from the great humidity which it contracts during the rainy season, and the extreme heat to which it is again suddenly and constantly exposed. By the repeated shocks of the sea, huge masses of this black crust fall to the bottom of the cliffs, and relieve the sameness of the shore. They first resemble rocks on which the sea breaks, but their corners are soon worn away, and they soon present but a heap of sand. On the whole extent of the coast, as far as Cape Verde, there is not a single piece of granite. Cape Boiador, which lies in 26° 7′ N., and 14° 30′ 34″ W., is not very remarkable. When seen from the northward, it presents a strand of red sand, having a gradual descent toward the sea: and its western extremity, which is very low, forms a small bay with the cliff which immediately follows. The position here given is that of the easternmost point of the cliff, which has been selected as the most remarkable one in the neighbourhood; its height being about 70 feet. The depth along the coast, 3 or 4 miles to the northward of Cape Boiador, varies from 12 to 20 fathoms, increasing gradually toward the parallel of the cape. The nature of the bottom throughout is of sand and broken shells, or of sand and gravel. At the distance of 3 leagues to the seaward there are 25 fathoms of water; and the sandy bottom becomes more general: a circumstance which is common to all the African coast.

It is possible to anchor in the small bay of Cape Boiador, but the bottom is foul. At the distance of half a mile from the shore there are 13 or 14 fathoms of water.

From Cape Boiador the coast trends S.W. ½ W. [*S.* 20° *W.*] about 22 leagues, to a very remarkable cliff, about 300 feet high. This cliff seems to be the *Penha Grandé*, or *Great Rock* of the charts. As its height considerably exceeds that of any spot in its vicinity, it may serve as a good land-mark.

All the coast thus far presents, alternately, cliffs and sandy beaches; but more particularly the former. It is from 150 to 200 feet in height; being flat at its summit. The land in the interior, on which brushwood is very scarce, is of a darkish colour.

The depth of water on this part of the coast is considerable. At 2 miles from the beach, bottom cannot be found at 22 fathoms. On the parallel of 25° 50′ N., and at 1½ miles from the shore, bottom may be had in 15 or 20 fathoms, gravel and broken shells. The depth again increases; and under the Penha Grandé, at a mile from the foot of the cliff, there are 26 fathoms, hard bottom, with gravel and broken shells. The summit of the Penha Grandé is in 25° 7′ 6″ N., and 14° 50′ 53″ W.; it is flat and arid; all its declivities are precipices from broken earth, which has fallen down, the colour of which is gray. The whole of this coast is perfectly clean, even to the beach.

From the Penha Grandé, after a slight indentation, the coast trends S.S.W. ½ W. [*S.* 6° *W.*] 8 leagues, and includes a slender bay, now called *Garnet Bay*. It then forms a well-defined elbow, and trends nearly S.W. by W. ¾ W. [*S. W.*] 29 leagues. On all this extent, it presents one continued cliff, with the exception of two or three places, where it slopes to the sea; the cliff being about 150 feet high. Frequently, at a short distance from the water's edge, between the cliff and the sandy rocks which here cover the beach, there is a chain of white sandy downs. The summit of the cliff is even and horizontal; it follows nearly a right line, interrupted only by some small flat downs, scarcely perceptible. The whole of this beach is continually washed by an exceedingly heavy surf, and there is no sign of vegetation on the whole coast.

GARNET BAY, which is the *Angra dos Ruivos* of the Portuguese, abounds with cod, bream, hake, and various kind of other fish. Two leagues to the southward of it are seven small table-hills, called the *Seven Capes*, which constitute an excellent land-mark.

From the elbow formed by the coast, on the South side of Garnet Bay, to the southwestward, the depth diminishes a little; from 16 fathoms it gradually lessens to 11 fathoms, and continues nearly the same in a space of 6 miles. We shall now have arrived at the parallel of 24° N., and immediately abreast of an interruption in the cliff, at a beach of white sand, about a league in extent. Beyond this sand, which does not reach far into the interior, is a body of still water, having the appearance of a lake or river, with a sandy islet in the middle of it. This is the upper part of an inlet named *Rio do Ouro*, or *Gold River*.

Continuing a south-westerly course, along a neck of sand, which separates the river from the ocean, and which is alternately interspersed with cliffs, after running 10 leagues from where it was first observed, we arrive at its entrance. In this run, at the distance of 1 to 3 miles from the shore, the soundings vary from 16 to 8 fathoms, with a hard bottom, and shells. On approaching the river, white sand will be found.

RIO OURO, OR GOLD RIVER.—The entrance of this inlet is in 23° 36′ N., and 15° 58½′ W. Its breadth, taken from the outer cliff on the West bank, to the cliff on the bend of the coast forming the East bank, is 7½ miles; but a very low sandy point stretches to the southward, from the West bank, in such a manner as to leave only a free channel of a mile in width at the utmost.

Neither to the northward, nor at the entrance of this channel, does any island exist, although the old charts mark several; but, at 20 miles to the N.E. of the northern point of the entrance, and on the meridian of the islet in the interior before mentioned, there is a cliffy mound of sand, which, being insulated on a low sandy flat, might have been mistaken for an islet. This, however, forms a part of the bank with which it is connected at its southern point.

No particular current was observed off the Rio Ouro, which consequently does away with the supposition of a river emptying itself by this opening. At the distance of about 3 miles seaward from the mouth of the inlet, the bottom is of sand and shells, with a depth varying from 9 to 16½ fathoms. In the middle of its entrance is a circular breaker, 1 mile in diameter, on which there appears to be very little water. The northern point is wholly

surrounded by breakers, but they are only a continuation of the surf which is found on the whole coast. The adjoining sea is well stocked with fish.

From the southern point of the River Ouro, the coast trends nearly, S.W. [*S.S.W.*] The cliff continues to a distance of 5 leagues, when white sandy downs succeed, of which the summits are mostly flat. At 1 league northward [*N.N.W.*] from the extremity of the cliffs, and at 3 miles from the coast, there is a bank, having only 32 feet of water; its direction is parallel to that of the coast, and it is about 2 miles in length. Thirteen fathoms have been found on the edge of this bank; to the northward of it the bottom is sand and shells; to the southward, fine sand; and on the bank itself, broken shells.

ANGRA DE CINTRA, OR CINTRA BAY.—At the distance of 3 leagues from the southern extremity of the *Fisherman's Cliffs*, or the Cliffs of the Rio Ouro, amongst a number of even downs, there is one somewhat elevated above the rest, extending parallel to the coast. From being flattened at its summit, and having its southern extremity peaked, it becomes remarkable. It is situated at a short distance from the beach, at the head of a small bay, named *Angra de Cintra.* This bay is sheltered, on the North, by a very low, sandy point, which, detaching itself from the coast, runs parallel to it, and a reef projects from its southern extremity, which may be considered as a continuation of it. The break in the coast, between the northern and southern reefs, which forms the opening of this bay, may be about 6 miles; but, on doubling the northern reef, the bay is found to extend about 4 miles inside of the sandy point which protects it.

The depth of water in this bay is not great; at the distance of a mile inside it is only 4½ fathoms, sandy bottom; but the stillness which prevails in it attracts a great number of fish, and it forms a harbour for the night to the fishing-vessels of this coast. It is to be observed, that besides the reefs stretching from the North and South points of the bay, there is also a rock near the middle of the entrance, which breaks in blowing weather.

All the coast from the Bay of Cintra to the Rio Ouro is well stocked with fish, and is frequented by eighteen or twenty small vessels from the Canary Islands, which catch and salt fish for the consumption of those islands. Fresh water may be obtained by digging at the foot of the high down, or sand-hill, above mentioned, as a place of observation.

It does not appear safe to attempt the channel into Cintra Bay, between the point and the northern reef, as the breakers seem to be connected between them; but the entrance to the southward of this danger is quite safe. The least depth found was 6 fathoms, in the middle of the entrance. During the time of the rollers, as the sea breaks over this in 6 fathoms, vessels should pass either to the northward or southward, where they will find from 9 to 10 fathoms. The fishermen who frequent this creek attract some few Arabs, or Moors, to the spot, who seem to have no fixed habitation there, nor on any other part of the coast. These belong to the fourth tribe, who are dispersed in the desert, and called the "Tribe of Thieves," complete wanderers and vagabonds. It is composed of the discontented of the three tribes already mentioned in page 336, and which are scattered along the coast from Cape Boiador to the Senegal; they subsist exclusively on dried fish, and the plunder from wrecks, *which formerly were so frequent here.* No advantage can be derived from any communication with these poor and miserable barbarians.

In the Bay of Cintra, at 2 miles from the beach, are from 9 to 16 fathoms of water; the bottom of sand, sand and gravel, sand and shells, sand and mud, generally covering siliceous or flinty rock, of the same nature as the neighbouring coast. Toward the bottom of the bay the mud becomes thicker; and here the anchor would sink deep into a bed of greenish clay, which is excellent holding-ground.

The Down of Cintra, according to M. Roussin, is in 23° 5′ 25″ N., and 16° 10′ W. The magnetic variation on the same parallel, at 2 miles from the shore, in February, 1817, was 19° 33′ W.

Anchorage may be found along the coast from Cintra Bay to the Rio Ouro; but the bottom, from being composed of siliceous rocks, must be unfavourable for holding.

From Cintra Bay the coast trends S.S.W. ½ W. [*S.* 10° *W.*] to a distance of 7 leagues; the shore is low, but it gradually rises, and becomes a continued down of white sand. At 3 leagues to the southward of this bay, in the interior, may be seen four or five small insulated sandy downs, which are rather higher than the adjacent ground, and, with the

lower one, may serve as a mark for this coast. These heights are called the *Downs of Cintra*, and they can be seen at the distance of 4 or 5 leagues only.

ST. CYPRIAN BAY.—Having run 6½ leagues along a moderately high coast, which presents alternately cliffs and sandy beaches, we arrive at an inlet, or bay, formed by rather a deep bend of the beach. The bottom of this bay is low, and the sea breaks violently on it. The eastern point of the bay is formed by a cliff, 150 feet high, having a circular form toward the sea, with a flat top, and much resembling a fortification. The western side is also formed by a steep cliff, which, after extending 2½ miles to the westward, turns abruptly to the S.W., and forms Cape Barbas, in 22° 19½′ N., and 16° 39′ W. The bay formed by the cape is that which bears the name of *St. Cyprian*.*

The Bay of St. Cyprian, being open from *N.E.* to *W.N.W.* (*true*), is unsheltered from the prevailing wind on the coast. In consequence of this there is generally a heavy sea in it; and the anchorage, although on a bottom of sand and mud, in 10 to 20 fathoms, offers very little security, and should be resorted to only in cases of necessity. The abundance of fish in this bay frequently attracts the fishermen from the Canaries, who, seduced by the hope of being quickly laden, and the appearance of a moderate breeze, anchor too near the bottom of it. In this situation, if the wind freshens up, being equally incapable of beating out with their crazy vessels, or with their ground-tackle of riding out the heavy sea which sets in, they are sure to drive and be thrown up on the beach, where their crews frequently lose their property and lives; or, which is not less deplorable, are robbed and detained in slavery by the Arabs. Here the magnetic variation was observed to be 19° 28′ W., in March, 1817.

FROM CAPE BARBAS the coast trends nearly W.S.W. [*S.W.*] 3 leagues. It is formed almost by one uninterrupted cliff, about 80 feet high, at the foot of which the sea breaks violently. At 1 mile from the beach there are from 9 to 12 fathoms; and at 2 miles, as much as 17 fathoms; with a bottom of muddy sand, or sand and broken shells. The coast then declines into white sandy downs, studded here and there with cliffs. At about 3 leagues from this it forms rather a remarkable little bay, with a shore of white sand. The mouth of this bay is barred, at about 3 miles from its bottom, by a flat of banks and reefs, on which there is very little water. These reefs serve as a foundation for an islet, called that of *Pedra da Gall*, and another small islet, which M. Roussin has named *Virginia*. These islets are merely rocks, of a nature similar to that of the coast. The first, which is rather higher on the northern than on the southern side, is about half a mile in circumference. The latter, or southern one, is three times that size, and has some sandy patches. It is also 3,000 fathoms from the coast, and about a league *S. by W.* (*true*) of Pedra da Gall. They are connected together by a chain of flats, which stretches 400 fathoms to the S.W., and 1,000 fathoms to the N.E. of Pedra da Gall. At 1 mile westward from these islets may be found 18 fathoms of water, with muddy sand. The depth increases to the southward, and the bottom becomes harder.

From Pedra da Gall to Cape Blanco the distance is 29½ leagues. The coast in this extent is nearly straight, and moderately high; its *true* direction is *S.* 15° *W.*, and it presents only a few indentations of a trifling depth. It is one continued down; the whiteness of which becomes more vivid on approaching to the southward. In some places it presents peaked cliffs, in others there is a gentle descent toward the sea, and the whole is devoid of vegetation.

CAPE CORVOEIRO.—Having, says M. Roussin, in our way from the northward, reached the parallel of 21° 50′ N., after passing a sandy beach of about 2 leagues in extent, with few indentations, we find ourselves abreast of a moderately high cliff, whose irregular summit forms a striking contrast with the uniform smoothness of the adjoining coast. This cliff is 5 miles in length N.E. and S.W. [*N.N.E.* and *S.S.W.*], after which the downs again commence, having previously formed a small bay to the southward of the cliff. The most salient point of the cliff is CAPE CORVOEIRO; but it is not well defined, and is only remarkable from the breaks in the beach where it is situated. The strength of the current here is the same as on the whole coast, about nine-tenths of a mile per hour; but farther out to sea it loses half that velocity. Between the islets and the coast, at the distance of half a mile from the latter, the depth is from 6 to 9 fathoms, with a bottom of sand, sand and shells, or sand and rocks. At the

* The *Bay of Tribulation* of M. Roussin. But we consider a change in the name quite *unnecessary, and,* therefore, improper.

distance of a mile from the coast it varies from 10 to 20 fathoms, with mud and sand. The muddy bottom prevails to the southward of Cape Corvoeiro, and all this coast is perfectly safe. At 25 leagues to the northward of Cape Blanco we discovered, from the masthead, that the beach, along which we were running, was formed by a tongue of sand from 2 to 3 miles in breadth, beyond which we observed water. This is now called *Greyhound Bay*, and is situated to the eastward of Cape Blanco. From Cape Corvoeiro the coast is formed of white and red sandy downs, assuming various shapes, alternately terminating at the water's edge in broken cliffs and low sandy beaches, on which there is a heavy surf.

CAPE BLANCO, in 20° 47′ N. and 17° 4½′ W., is the southernmost face of a white cliff, about 150 feet high. It rises vertically from a gentle slope which extends from its base to the sea. With a point 4 miles to the northward it forms a bay, at the bottom of which is a beach of white sand, interspersed with masses of the cliffs. Through one of these masses the sea has perforated a hole, which, in shape, much resembles an arch. The anchorage in the bay, as well as on the whole coast from Cape Corvoeiro, is good: a bottom of muddy sand prevails throughout, with a depth varying from 19 to 12 fathoms. At 1 mile to the southward there are 9 and 12 fathoms, and large vessels may anchor at this distance to the eastward, where they will be sheltered from the prevailing N.N.E. and N.W. winds.

The portion of coast terminated by Cape Blanco is a long promontory, which, projecting from the main, forms with it a bay of nearly 8 leagues from North to South, and about 6 broad. The bottom in this bay is generally composed of soft mud, and there is a depth of water varying from 40 to 17 feet, reduced to the lowest springs. On the western side there is excellent anchorage for vessels of a middling class.

In a radius of 8 or 10 miles round Cape Blanco, and in Greyhound Bay, the currents are subjected to regular tides. The flood sets E.N.E., and the ebb W.S.W., the greatest velocity of either being from 1 to 2 miles per hour; but it attains this rate only when the wind blows with it. The greatest rise above the level of the lowest tide is 10 feet, and it is high water, on the second day after full and change, at 0^h 15′.*

All this coast abounds with good fish, as cod, bream, soles, &c. On the little beach eastward of Cape Blanco, a single haul of the seine has produced a thousand pounds' weight. The best kind of turtle, namely, the green kind, also abounds hereabout. According to the information obtained from the Canarian fishermen, who frequent the coast, a small quantity of drinkable water may be obtained by digging a little to the northward of Cape Blanco. This spot is occasionally visited by some Arabs, who possess a few muskets, and against whom it is necessary to guard. Here the magnetic variation, in March, 1817, was 18° 9′ W.

In 1830, *Captain* (now *Sir*) *Edward Belcher*, in H.M.S. *Ætna*, by the mean of several observations, assigned to the extremity of Cape Blanco lat. 20° 46′ 26″ N., lon. 17° 4′ 10″ W. This gentleman has given a geological description of the cape and neighbouring country, which is inserted in the *Journal of the Royal Geographic Society* (vol. ii. pp. 299—303), and in which he particularly notices the practice of the Canarian fishers, in the vicinity of Greyhound Bay: the anchorage of these vessels, schooners, with their boats, is in a bay about 3 miles North from the cape, where they are quite sheltered from N.N.W. to S.S.E. Those of the fishermen whom Captain Belcher met with were courteous and communicative, and they stated that their usual fishing-ground is in 25 fathoms, where they take fish of from 8 to 60 pounds each, and that their average daily work is about 3 cwt. in the boats. The schooners have polacca foremasts; and, when fishing, they furl all the sails in one; their burden is from 100 to 150 tons. The fish taken by the *Ætna* were porgy, mullet of several kinds, rock-cod, and red-snappers,

* "*The tides about Cape Blanco* are irregular, and much influenced by the land near which they run. High water, at full and change, may be looked for about noon; the greatest rise, under every advantage of springs and winds, does not exceed 6 feet. Southward of the parallel of the cape the indraught has a velocity of 2·6 miles, and the offset or ebb the same. Eastward of the meridian of the cape the tide bends northerly, and at 3 miles chord its velocity appears from S.W. to N.E., about 2¼, following the circular course into Greyhound Bay. North of the parallel of the cape the ebb sets North, and flood South; and, close in-shore, the tide is considerably weaker than at 3 miles, where its greatest influence may be expected."—*Captain Belcher.*

probably called bream by former voyagers. Mussels and other shell-fish are very abundant at low water.

The summit of the Blanco peninsula is composed of lines of sand hills and rocky eminences, just what one would expect to find if the sea were to quit its position, and show us the beds over which it flows. In every position, where a bush or rocky islet is prominent, there, on its southern side, you will surely find its sand hill—a proof of the prevalent winds, as well as an admirable model of the formation of shoals, &c., under water, and pointing out most perfectly the 'steep-to' approaches to banks, past which rapid streams or currents flow, with their concomitant shallow tail, formed by dead water or eddies.

With the exception of these newly-formed and forming sand-hills, the whole surface is covered, in a *most extraordinary manner*, with shells, of all dimensions, and of the species generally found in the bay. These are loose, and some are more than 60 feet above the level of the sea! *

The Spaniards affirm that there is no rainy season here, but strong northerly and north-easterly winds the whole year. In June and July they were North, N.N.E., and N.E. Highest temperature of air in the shade, 75°; of the water, 76°.

BANK of ARGUIN, &c.—The Bank of Arguin commences at 4 leagues to the southward of Cape Blanco. It is a great shelf of about 30 leagues in length, and reaches to the southward of Cape Mirik. The North point of it is in lat. 20° 33′ 12″ N., lon. 10° 56′ 30″ W. The coast between this point and Cape Blanco is replete with shoals. The most considerable one is that of the *Bayadère*, at $1\frac{1}{8}$ miles to the southward of the cape. There are only 20 feet of water on this shoal, and it occasionally breaks. Another lies W. ¾ N. [*W. by S.*] 3 miles from the cape; and a third at 8 miles S.S.E. ¼ E. [*S.E.*] of it; on which, like the first, 20 feet of water have been found. The channel, leading to the anchorage, eastward of Cape Blanco, lies to the northward of these shoals.

The *Bank of Arguin* is a flat of sand, constantly increasing, of the same nature as the coast. The body of it is hard, and covered with broken shells. Its outer edge, which has been traced from numerous soundings, has been fixed at the depth of 8 fathoms, as no vessel can run within this limit without risk; and, at a very short distance to the eastward of this boundary, there are less than 4 fathoms. No particular part on the edge of this bank has been seen quite dry; but close to the breakers, which occur in many places, there are not more than 10 feet of water; and the shallows between them do not appear to have more.

Between the North point of the bank and its western extremity, situated in 20° 6′ 20″ N., and 17° 7′ 30″ W., on advancing from seaward, the soundings progressively decrease. At 10 leagues to the westward, from 40 fathoms they decrease to 8, with a very gentle ascent; but to the southward of this parallel the bottom becomes more uneven; and from the point where the *Medusa* was lost (see page 342), in lat. 19° 53′ 42″, lon. 17° 0′ 35″, a great irregularity takes place.

From the westernmost extremity, the edge of the bank trends S.S.E. [*S.E.* ¼ *S.*] and extends as far as Cape Mirik. The nature of the ground about the Bank of Arguin has a very remarkable characteristic, which may prove of great service to navigators. From the depth of 8 fathoms, which has been assigned as the limits of this bank, to that of 25, to seaward, including an extent of more than 5 leagues, the lead invariably brings up a mixture of sand and broken shells; and, in proportion to the proximity of the bank, the latter prevail. Beyond the depth of 25 fathoms, as far as that of 45 and 50, at 8 or 10 leagues to seaward, the bottom is entirely of white sand. Hence it is evident, that by soundings, and a rough observation for latitude, the distance from the Bank of Arguin

* On page 348 we have alluded to the captivity of a portion of the crew of the brig *Courier*, in 1844, on the *Island of Arguin*. This island lies in the mouth of a bay to the S.E. of Cape Blanco. According to Captain Grover's account it is about 8 miles from the main land, between which and the island the water is shallow. To seaward there is a depth of from 5 to 7 fathoms *close to the shore*. On this point the evidence appears to be conclusive. It is formed of a whitish rock, covered with shifting sands to the depth of 9 feet. The South end rises to about 30 feet. The island produces no wood, and only a small caustic shrub, but it has excellent water, though of milky appearance. The wells are difficult to find, but are important. The *number* of inhabitants was about 60.

may always be known. Should less than 25 fathoms be found, with a bottom of sand and broken shells, you will be less than 5 leagues from its edge; and in proportion as shells predominate in the soundings, you will be nearer to it, and should avoid getting to the eastward. Should you have more than 25 fathoms, with fine sand, you will be more than 5 leagues from it. To the northward of the parallel of 20° N., this may be particularly depended on; to the southward of that limit, it is subject to some exceptions: but as the bank then takes a direction S.S.E. [*S.E.* ½ *S.*], it becomes no longer dangerous, if a ship is kept on a wind in 20 to 25 fathoms, and sounds frequently. Henceforth we may conclude (which all mariners must be convinced of), that a strict attention to incessant sounding is so indispensable, as to need no further recommendation.

CURRENTS.—It has been already shown, in page 205, that the prevailing currents set from North to South along the whole coast. Along the edge of the Bank of Arguin, as far as its western extremity, this direction is constant; and in the rainy season, should any deviation be experienced, it may be relied on to happen very seldom. One proof of this may be adduced. On the 13th of July, when the wreck of the *Medusa* was found by the brig *Argus*, after thirteen days' absence from the frigate, it was abreast of Portandik, at 15 leagues from the shore, a distance of 90 miles, and nearly on the meridian of the place where she was lost. It must, therefore, have driven at the rate of 7 miles per day along the coast.

CAPE MIRIK is that point of the coast which terminates the Bay of Arguin on the South, being a very low sandy point, on which there is a small down.* It is surrounded by the southern part of the Bank of Arguin, and cannot be approached by large vessels, on the West, within 3 leagues, and on the S.W. within 2. The magnetic variation, at the southern anchorage, in April, 1817, was found to be 18° 49′ W.

TANIT BAY.—The coast from Cape Mirik tends S.S.E. ½ E. [*S.E.*] 10 leagues, it then forms a complete elbow, gradually trending S. ¾ W. [*S. by E.*] It is low, and presents a continued chain of small regular downs, composed of white sand, and interspersed with small bushes. To the northward of the bay, formed by the bend of the coast, some downs may be observed which are rather higher and more insulated than the rest. A few huts are seen near the beach, and in the dry season numerous parties of the thieving tribe assemble here to catch fish and dry their stock. Two large pieces of water may be seen between the high downs: but whether these be fresh or salt is unknown. The latter seems most probable. This bay bears the name of *Tanit*, and the North point of the down, at the bottom of it, as observed by Baron Roussin, is in 19° 3′ 48″ N., and 16° 12′ 20″ W.

ANGEL HILLOCKS.—*From Tanit Bay* the general direction of the coast is South [*S. by E.* ¾ *E.*] in an extent of 12 leagues. At the distance of 4 leagues from the termination of this bearing are some downs, which are rather higher than the rest of the beach, and with some bushes on their surface. The beach itself is formed by a very low flat of quick-sand. These downs are the *Angel Hillocks*, composed of sand, of which the summit is from 15 to 20 fathoms above the sea, and they constitute a useful land-mark. The are divided into two groups: the summit of the northernmost, which is much smalle than the other, is studded with tufts of brushwood; while the southern, which is formed of eight or nine hummocks, is nearly destitute of it. The latter, which is the highest, stands in 18° 29′ 30″ N., and 16° 2′ W. The coast, from these hillocks, gradually declines in height, and more so as it approaches to the southward, when it soon falls into a uniform line of sand, with occasionally a bush here and there, scarcely above the level of the sea.

ANGEL BANK.—No part of this coast, southward from Cape Mirik, should be approached within 5 miles, nor to a less depth than 6½ fathoms. By attending to this rule, all dangers will be avoided, and, amongst others, a shoal which extends outward, 3 miles from the coasts, abreast of the northern part of the Angel Hillocks, from which it derives its name. On this bank there are regular soundings on a bottom of sand, with sand and broken shells, affording anchorage in case of necessity. On receding from the beach, the depth increases; and, at the same distance from it, is greater than to the northward of the hillocks.

PORTANDIK.—At 4 leagues to the southward of the Angel Hillocks, on rather

* Captain Owen gives this down in 19° 25′ N., and 16° 34′ W. Baron Roussin as 19° 22′ 14″ N., and 16° 31′ 21″ W.

an elevated part of the coast, and a little within the beach, are two palm trees, without branches, standing close together. The northernmost is the smaller of the two, and they are the only palms to be seen on the coast between this and Cape Boiador. They stand in lat. 18° 18′ 54″ N., and Portandik is supposed to have existed at about 1 mile to the southward of this spot. Not a vestige now remains sufficient even to indicate to strangers the spot on which this little establishment once stood. From the two palm trees, the coast trends nearly S.S.W. [*South*], then to S.W. [*S.S.W.*] It is straight and low, interspersed with small bushes, and presents a continued sameness. In an extent of 35 leagues there are only two downs of red sand, covered with brushwood, and discernible only at about 2 miles from the beach. One is in lat. 17° 25′ N., the other in 16° 55′ N. From the mast-head some sheets of water at the foot of these downs may be seen. At 2 leagues to the southward of the latter, the interior of the country becomes a little clothed with brushwood, and occasionally presents some level plains, but the coast remains uniformly barren.

ENGLISH GUM TRADE.—The Dutch have the credit of being the first who introduced the Gum Arabic, commonly called Gum Senegal, into Europe, in the early part of the 17th century, when they carried on the fishery in the Bay of Arguin. The French merchants of Bordeaux and Nantes first brought it, however, into general repute, and decided its purity and superiority to the gums of the East. From 1760 to 1779, England possessed the Senegal, and the trade for the gum; and by the Treaty of Versailles, 1763, reserved to herself the exclusive possession of this commerce, which she protected and maintained. The English demolished the forts and establishments at Portandik and Arguin, which had been formed in 1724 by the old India Company of France, in order to bring the whole of the gum of the African forests into the River Senegal. In 1779, the French obtained re-possession of the Senegal; but, by the Treaty of 1783, it was agreed that the English should have the liberty of carrying on the gum trade from the mouth of the *River St. John* (3 leagues north-eastward of Cape Mirik) to the Bay and Port of *Portandik*, inclusively; provided that they should not form any *permanent* settlement, of what nature soever, in the River St. John, or the Bay of Portandik. The treaty is still in force, as no alteration of it was made by the treaty of 1814; which merely stipulated the engagement of the English government to restore to France, in full right and sovereignty, the possessions of Senegal and Goree. The transfer took place in 1816, when the English withdrew to their other settlements on the coast; leaving the gum trade entirely in the hands of the merchants of Senegal, although they possessed an indisputable right to the trade from the Bay of Arguin to the Bay and Port of Portandik.

At the commencement of the year 1821, the British merchants of the Gambia obtained the support and assistance of the local government, in the attempt to renew the gum trade at Portandik, and revive that friendship and good will which formerly subsisted between them and the Moors in Senegal. Commodore Sir George Collier was solicited to order a vessel of war for the protection of the trade, and to convey presents to the chiefs of the Trazzarh or Tarassa Moors; and, for this purpose his Majesty's gun-brig *Snapper*, commanded by Lieutenant T. Evans, was selected, and proceeded on his important service. The trade afterwards revived, and was going on with the Moors in 1834, when it was unjustly interrupted by the government of Senegal. The particulars of this interruption, as given in evidence before the House of Commons in 1842, by G. C. Redman, Esq., are as follow:—"In the years 1834 and 1835, the gum trade was interdicted by France by a blockade. The trade had been restricted to France and England, by treaty between those powers, in 1783 and 1814 (as above stated). During the blockade, a treaty was made with the native chiefs, dated August, 1835, which gave 5,000 dollars per annum to the king of the Trazars, to give the French the exclusive supply of gum; and further, the inhabitants of Senegal added, on condition that no trade should be carried on at Portandik with the British, that they would give the Trazars a proportionate contribution from every house, and even every hut in Senegal, the most insignificant of which should not be less than two dollars. From this cause, the Trazars, finding that the French possess the greatest power here, and being a warlike nation possess the keys of all the country, have prevented the English from carrying on any trade in gum since that period."* The subject of remuneration to our merchants, and to the proper adjustment of the mutual treaties, is at present (1845), the subject of conference between the diplomatists of the respective powers. The loss to this country, by the stoppage of the trade, is also stated by

* *Parliamentary Report, West Coast of Africa, Part I. pp. 176, 177, 183.*

the same gentleman as at £50,000 per annum; and that consequent upon the French transactions at Portandik, at £76,000.

PORTANDIK to the RIVER SENEGAL.—On the parallel of 16° 35′ 24″, and at the termination of the 35 leagues of coast already described, we arrive at the huts of *Inguiagher*, or the spot called by the French the *Marigot* or Lagoon of *Mosquitos*. This in the rainy season forms a mouth of the River Senegal, the banks of which are covered with mangroves. At the distance of 2 or 3 miles from the beach regular soundings may be found, in from 7 to 13 fathoms, fine sand, occasionally mixed with mud, and affording safe anchorage between this and the palms of Portandik. To the southward the depth gradually increases.

The Marigot of Mosquitos is about 12 leagues to the northward of the Isle St. Louis, in the Senegal; and it communicates with the sea only when the rains have swollen the river. It then covers the bank at its entrance, which may be passed over by boats; but they must be prepared against the surf which is common to it, as well as the entrance of the Senegal. To the southward of this *Marigot*, the river is separated from the ocean by a straight tongue of sand, formed by small white downs, nearly bare, and gradually becoming lower toward the extremity. Within this tongue of sand, the stream of the Senegal washes a number of small islands which lie parallel to the coast, and on which a covering of thick bushes gives the country some appearance of fertility. They are known by the name of the *Antelope Islands*, *Griel Wood Island*, and *Thiong Islands*. The last is at a very short distance to the northward of the Isle of St. Louis.

Griel Wood Island is distinguished by its bushes, among which are some trees higher than the rest, presenting a remarkable contrast to the barren desert of 200 leagues, which precedes it. Its distance from the Isle of St. Louis, in a straight line, is not more than 5½ leagues. Both to the northward and southward of Griel Wood Isle, the stream of the river may be distinctly seen from the mast-head, running between the isle and the beach; and it is the surest mark for discovering the landing-place to the northward of the bar.

A vessel may run along the coast, at the distance of 2 miles from the beach, in from 9 to 14 fathoms, over an excellent bottom of thick green mud.

SENEGAL.—On continuing your route to the southward, the French establishment of St. Louis, in the Senegal, will soon be seen. This place is remarkable for its white buildings, and a very high palm tree, which stands conspicuously close before the flag of the fort. The latter is in lat. 16° 0′ 48″ N., and lon. 16° 33′ 6″ W. The western bank of the Senegal is so narrow and low, abreast of the northern part of this island, that the town appears to stand on the sea-shore; and it is only on nearing it, that the channel which separates them can be seen.

A little Moorish town, called *Gattandar*, consisting of huts on a sand hill, stands upon the strand, opposite the town of St. Louis. It was built by the negroes engaged to open the communication in canoes with vessels arriving, and checks the sands, which are constantly in motion. On the S.W. part of the Island of St. Louis is a down, on which cannon are placed. From Gattandar, the distance of the bar of the Senegal is only 2 leagues. The anchorage off the mouth of the river may be taken in 7 to 14 fathoms, according to circumstances. This depth extends from 2 to 4 miles from the bar.

The mouth of the Senegal presents nothing remarkable when seen from the northward. The breakers which prevail on the whole coast as far as *Point Barbary*, the northern point of the entrance, prevent those on the bar from being distinguished; and vessels may run past without seeing them, if they keep at too great a distance from the shore. From Gattandar you may run at the distance of a mile from the beach without danger; which will enable you to observe the smallest alteration in the coast. A small post in the centre of the river, abreast of the *English Islet*, where there is a signal-post, and a guard-house on *Babagué Island*, at a short distance to the eastward of the bar, will then be passed in succession. This guard-house is a remarkable small square house, near which there is a second signal-staff; and a vessel may anchor when this guard-house bears E. ½ S. [*E. by N.*] As the winds generally blow from the northward, in consequence of the facility for communication with the shore, it is advisable to anchor rather to the northward than to the southward of the bar.

The Bar of the Senegal is not stationary. The western bank of the river, from the Isle of St. Louis, is so low that high tides completely cover it, and, at times, force open a new

channel. That now described was found in February, 1815. Its northern point is in lat. 15° 55′ 18″ N., and lon. 16° 32′ 40″ W., and it increases gradually to the southward. Here the magnetic variation, in May, 1817, was 17° 32′ W.

The dangers attending the bar of the Senegal are well known to be of no trifling nature. In the rainy season, and even in March, when the river, increased by the rains, discharges a greater body of water into the sea, the bar is frequently impracticable even by decked boats. The waves, caused by the impetuosity of the river water meeting with that of the ocean, are very considerable, and succeed each other so rapidly that it is impossible to find a *smooth*. It is not uncommon, in these cases, to see breakers at the distance of a mile from the bar, and in 8 fathoms of water. From the month of April to the end of September the bar may generally be crossed by decked boats, and sometimes even by canoes; but it is advisable that they should be steered by natives.

Vessels drawing 10 feet of water cannot cross the bar. Those of a moderate size only should, therefore, be employed in the commercial navigation of these parts; otherwise the loading and unloading, when necessary to employ lighters, becomes very expensive. Inside the mouth the depth is from 6 to 8 fathoms; and, with the assistance of the tide and a pilot, a vessel may very easily beat up to the Isle of St. Louis.

CURRENTS.—It has already been said, that the general and almost constant direction of the current is along the coast from North to South, as far as the mouth of the Senegal. Abreast of this opening, and in a space of several miles to seaward, the river tides affect the general uniformity of this current. The flood and ebb tides are alternately felt at the bar and anchorage; they have no settled direction, but may be considered as setting about N.W. and S.E.; and are frequently so strong as to make the vessels tend at the anchorage, or at least to lay with their broadsides to the wind, in the strongest breezes. This anchorage is rendered very inconvenient by the short sea which is always upon it.—*See page* 174.

The preceding descriptions are chiefly those of the Baron Roussin. The following, from our former edition, may also be acceptable.

From Santa Cruz, Tenerife, to the River Senegal, the *true* and safe course is S.S.W. to lat. 18° 30′, before a ship hauls to the eastward. This is in order to avoid being set by the current too far to the eastward, or on the banks of Arguin, &c. From the above-mentioned latitude haul to the south-eastward, so as to make the land in about 16° 15′, when you will probably see the trees already noticed, which are the most remarkable on this coast.

If standing in for the land by night, heave a cast of the lead every hour, as you fall into soundings all at once, 50 fathoms close to the edge of the bank, at the distance shown by the chart, or about 8 leagues from shore, and thence shoaling to 8 fathoms at 1½ miles from it.

The bar of the Senegal is most easily passed in the months of July, August, September, and October; but it is very rarely quite calm. On the contrary, the sea frequently breaks against it violently. The waves, which strike against it, are always united in threes, or leashes. For example, when the sea is but slightly agitated, one may perceive three waves, perfectly distinct, approach and break against the bar, immediately after each other; and these three waves appear to be, as it were, connected; for there is often a considerable interval of time between the attack of the first three waves and the approach of the succeeding trio.

During the prevalence of rough weather, this series of assault by united waves incessantly prevails; but then these attacks follow each other so rapidly that the time between them is no longer perceptible. The sailors call the interval between the two assaults, when tolerably long, a *set-off*, because then the bar experiences a slight degree of rest, during which time it may often be passed; but frequently the violence of the waves is so great, and squalls succeed each other so rapidly, that there is no longer any interval between them; and, consequently no *set-off*.

Monsieur *Golberry*, to whom we are indebted for this description, adds, "The force and rapidity with which the waves of the same squall, and even the squalls themselves, follow each other, depend upon the general state of the wind and sea; but I have often remarked the latter to be calm at a distance, while the wind was blowing very gently, and, nevertheless, the waves continued to break with violence over the bar. I have attributed this to some convulsion of the sea at a distance, the effects of which may have extended to the extremity of this bay. After the cause of this considerable motion has ceased, the

surface of the sea soon becomes calm; yet the great mass of the element preserves, for a long time, an oscillating undulation in the open sea, the effects of which are very perceptible near shore.

"When the waves from the offing proceed toward, and break against, the bar, the passage is always difficult, sometimes dangerous, and often impracticable, at least without incurring the risk of destruction.

"The waves have attained their full violence when a second or third will pass over a shallop or small vessel, fill it, cause it to sink, or make it run aground; because the last two waves break in a semicircular form; the third, in particular, produces this effect, and the cause of the expansion may readily be conceived.

"The first wave which arrives does not form the semicircle, because it meets with no obstacle from the return of the particles of that which preceded it; and, when the attacks are separated by an interval, the first wave has time to disperse itself; the second forms an arch, because it meets with the divisions of the former, which are returning toward the sea, and which, forming an impediment, force it to rise; but the third wave, which at once experiences the combined obstacles of the returning waters of the first and second, can force its way only by a sudden inflation; and, as its rapidity is occasioned by a very strong impetus, it immediately rises and forms an arch, or semicircle, the height of which is in proportion to the rapidity of the wave at the time of its contact.

"It is, therefore, in general, this third wave which proves most destructive: the arch which it forms is so great in its diameter, as to cover a vessel completely in every direction; and it has often happened that barks have been raised, by this impetus, perpendicularly, as it were, on the end of the keel. This effect of the power of the waves was unfortunately experienced by a cutter belonging to the corvette *Rossignol*, commanded by M. de Corneillan, a lieutenant. The vessel had entered the river, having nearly reached the middle of the bar, which this officer thought practicable, when the third part of one of these bodies of water struck it on the stern, raised the hull perpendicularly, and placed it on the extremity of its keel: it remained for an instant in equilibrio, and then overturned.

"During my residence in Africa, there were wrecked, on the bar of Senegal, four ships and twenty-two shallops, by which a hundred and nineteen men were drowned."

On passing by sea within cannon-shot of the Isle of Senegal, it affords a very agreeable prospect. Fort St. Louis forms the principal object in this perspective. To its right and left extend the two parts of the town, the streets of which are well arranged; and, in general, composed of thatched cottages or huts, interspersed with some stone houses, covered, according to the custom of this part of Africa, with flat roofs.

The woods which line the East bank of the river appear, at this distance, to belong to the isle, and give it a cheerful and rural aspect; but this allusion disappears on a nearer approach; for no place can be more arid, parched, or deprived of vegetation, than the Isle of St. Louis, the soil of which is nothing but a fine shifting sand. Notwithstanding this, the population amounts to about 5,000 persons. The water of the isle is brackish and unwholesome.

For a copious description of the gum trade, see the Travels of M. Golberry, of which a translation has been published, affording most valuable and interesting details relative to all the country of Senegambia, &c.

The French trade on the Senegal is managed by a number of small vessels, which bring down the gum and other produce from Gallam, or Fort St. Joseph, the highest French settlement on the Senegal, lying in about lon. 11° 50′ W., to the mouth of the river, or Fort St. Louis. Gallam is the point to which the native produce is brought from the upper parts of the river, and around its sources. It consists of gold, ivory, gum (the chief article), and wax. The trade is opened on a certain day every year, and that is a great gala day. The Gallam fleet all go up the river at the same time, and come down at the same time; and there are a hundred or a hundred and fifty small craft which arrive at St. Louis in one day. For the protection of this trade, and to assist in furthering the mercantile interest, the government maintain two steamers of 200 to 250 tons, and drawing 4 or 5 feet water, fitted as men-of-war, and commanded by naval officers. The mortality is great among the Europeans on the upper parts of the river, but is not so much at the mouth.

The Baron Roussin continues his description as follows:—

WINDS.--The winds are not at all dangerous in the navigation of the coasts of the Senegal. They blow nearly along the coast from the N.E. and N.W. during the greater part of the year; and as, in the rainy season, the squalls always come from the S.E., and the winds which succeed them are very weak, when they once pass the S.W. quarter, getting under way is always easy. Those vessels in the road which cannot depend on their ground-tackle, may return to it when the squall is over.

SENEGAL to CAPE VERDE.—If a straight line were drawn from the anchorage at the bar of the Senegal to the outer rocks of the *Almadies*, on the western point of Cape Verde, its direction would be nearly S.W. by W. [*S. 40° W.*], and its length 31 leagues. The arc described by the intervening coast, and subtended by this chord, bends so little, that it would not exceed the whole length by more than 4 leagues, and its greatest depth would be 13 miles.

The coast, as far as 2 or 3 leagues to the southward of the Senegal, is just as low as that to the northward, and resembles it very much; it afterward becomes rather higher, but is uniform in general appearance. It is composed of a chain of white sandy downs, scattered over with brushwood, amongst which a small cluster of trees may be distinguished. It generally presents two well-defined plains. The first is that next to the sea, formed of white sandy downs, on which there appears some verdure. The second, which is considerably higher than the first, commences at about 2 miles in the interior, and is formed by downs of a grayish colour, which are covered with bushes.

In running for the Senegal, from the southward, the mouth of the river is more easily distinguished than when approaching from the northward, from its appearing more open. At the distance of 8 leagues from the mouth, and on the parallel of 15° 26′ N., a large red sandy down may be observed, entirely bare, which, to those ignorant of their latitude, may serve to indicate their distance to the southward of the bar. From this down, southward, the coast presents nothing remarkable as far as the *Little Paps*, of which the northern is in lat. 14° 56′ 24″ N., and lon. 17° 6′ 10″ W.

The *Little Paps* are the two highest downs between the Senegal and the *Paps of Cape Verde*. They are situated on the beach, and are easily known by a slight undulation of their summit, and three or four other small hills adjoining them to the southward. They are visible at the distance of 4 or 5 leagues. The *Bay of Yof* commences from this point.

The Little Paps bear E.N.E. ¾ E. [*N. 59° E.*] from those on Cape Verde, at the distance of 9 leagues. When running this distance, in fine, clear weather, both are frequently seen at once. The latter may be seen at the distance of 7 or 8 leagues. From about 8 leagues to the eastward of Cape Verde, the coast rises very much, and becomes more wooded. The country about the cape is covered with trees, amongst which there are several of remarkable height. All this coast may be approached within a very short distance. Wihin 2 miles to the northward of the village of Yof, situated near an islet of that name, there are 55 fathoms of water on a bottom of mud and sand.

CAPE VERDE is the westernmost point of Africa; it is the extremity of a peninsula formed on the North by the Bay of Yof, and on the South by the bay in which the Isle of Goree is situated, and is composed of moderately high land. To the westward, as far as the two paps of Cape Verde, as aforesaid, it becomes higher, and on the southern side of these two paps, the coast next the sea becomes nearly perpendicular. This point is usually taken for Cape Verde; it is not the westernmost part of the peninsula, but it is the highest. Its lat. is 14° 43′ 5″, and lon. 17° 33′ 7″. Cape Verde, as seen from the northward, terminates in very low land, on which are some unconnected hillocks, which, at a distance, may be taken for islets. The extreme point extends 1,000 fathoms still farther East, in a flat of blackish rocks, awash with the water's edge, and which, in two or three places, rise from 8 to 10 feet above the level of the sea. This rocky flat is called the *Almadies*, and the point which joins it, *Almadia Point*.

The sea on the Almadies breaks incessantly. Amongst the rocks are some smooth spots appearing like channels fit for boats. The flat may be coasted at the distance of a mile, there being, on the West, 35 fathoms of water; the bottom is of broken shells. Hence to the northward, in an extent of 3 miles, the depth increases to 80 fathoms, bottom of mud and sand. To the S.E. the depth is not so much; in running along these breakers and the coast, to a distance of 2 miles in that direction, which will extend to the meridian of the paps, the depth varies from 25 to 30 fathoms, the bottom, sand and shells, *or sand* and rock. The depth then continues to decrease to the E.S.E. The highest and

westernmost rock of the Almadies, which appears from a distance in the shape of a die, is in lat. 14° 44′ 29″, and lon. 17° 35′ 29″, as shown in the table, page 44.

CURRENTS.—The prevailing currents between the Senegal and Cape Verde follow the direction of the coast, in the same manner as those to the northward; and the idea of a current setting violently into the Bay of Yof, as formerly represented, is altogether false. The sea on this part of the coast is not particularly heavy nor dangerous; the smallest coasters of the Senegal and Goree expose themselves to it with impunity every day.

Southward from the Senegal as far as the parallel of 15° 20′, including an extent of more than 12 leagues, at 2 or 3 miles from the coast, the bottom is excellent, being of pure mud, with a depth varying from 12 to 30 fathoms. From this parallel, to the southward, doubtless the depth increases considerably. At 2 leagues to the westward of the Little Paps, for instance, there are from 64 to 70 fathoms of water. The muddy bottom continues here, and is so soft that the lead sinks deep into it, and the anchor alone would hold any vessel obliged to come to in consequence of calm. It is only in these cases that anchoring becomes necessary; if there is wind from either quarter, the formation of the coast will always allow a favourable board to any vessel well found and well managed.

CAPE VERDE to GOREE.—From Almadia Point to Cape Manoel the coast trends S.S.E. ½ E. [*S.E.*] in a distance of about 3 leagues. In this extent it is high, covered with trees, and generally terminates at the sea-side in basaltic cliffs or sandy rocks. In some places only the cliff slopes toward the interior, and forms small bays with beaches of white sand.

At 2,000 fathoms N.W. by W. ½ W. [*W. by N.*] off Cape Manoel and at half that distance from the coast, there is a group of rocky islets, called the *Magdalen Isles*, of which there are two principal ones. They are perfectly barren; even the largest, in the crevices of which were formerly some *baobabs*,* is nothing but a bare rock of a reddish colour mixed with basalt, and perfectly destitute of any vegetation. The shape of this islet is that of a crescent open to the westward, and its greatest extent is nearly North and South. On the North side it has a gap, forming a very small creek, which affords a landing. The other rocks are to the south-eastward of the principal islet, separated by a space of 1,000 fathoms, in which there is a depth of from 4 to 6 fathoms. The sea breaks with violence on all these rocks.

The space between the Magdalen Islands and the main seems to offer a safe channel; but it should not be attempted by a stranger. In coasting the shore from the Almadies to the Magdalen Islands, the soundings vary from 34 to 19 fathoms. These islands may be approached on the southern side within 100 fathoms.

Cape Manoel is high, formed of columns of basalt, and covered with very thick brushwood; at the distance of a pistol-shot from it, to the southward, there is a depth of 8 fathoms; and at 100 fathoms to the north-westward of its extreme point, close to the beach, is a small insulated rock. In doubling Cape Manoel the extensive bay is opened, which is formed by this cape and Cape Naze, which may be called the *Bay of Goree*. At the distance of 2,100 fathoms from Cape Manoel, E. ¾ N. [*N.* 65° *E.*] lies the Island *Goree;* and a vessel intending to anchor must steer for it, and may approach on the South side within two musket shots.

GOREE.—BAY of GOREE.—The Island of Goree with the Senegal fell into the hands of the British in 1809. By the treaty of Paris they were restored to the French in 1816. As far as regards climate, they are more favourably situated than any of our settlements on the coast. The population of Goree is between 6,000 and 7,000. The adjoining country is inhabited by the Jaloff nation. It is the seat of a flourishing trade. The French government attach much importance to its maintenance, and are expending large sums on its military defences. It is nominally a free port, but very far from a free port actually; they merely admit foreign timber and tobacco, but admit no British cotton goods, nor hardware.†

Goree Isle is merely a rock, about 400 fathoms in its greatest length, from N. ½ E. to S. ½ W. [*N. by W.* to *S. by E.*], and 167 fathoms in breadth. It is a volcanic produc-

* The *baobab* is a species of very large tree, of a fine green colour, but which does not keep its verdure all the year round. From the trees of this sort on Cape Verde that cape derived its name.

† Dr. Madden, Parliamentary Report, 1842. Part I., p. 206, and Part II., p. 508.

tion, composed of basalt and sand, of the same description as the Magdalen Islands and Cape Manoel, from which it seems to have been separated. The southern part, which is about 500 feet above the level of the sea, is the highest, and like a round mountain, may be seen at the distance of 5 or 6 leagues. The rest of the island is very low, and the North point is distinguished only by its batteries and private buildings. The landing-place is on the N.E. side of the island, between the point and the back of the mountain, to the southward, in a small sandy bay.*

Goree contributes nothing toward either the subsistence or comfort of its inhabitants. Its two springs, situated at the foot of a rock, on its southern part, hardly suffice for the consumption of two families, and the inhabitants are therefore obliged to get their supplies of water, wood, and all kinds of food, from the main.

The roadstead is to the N.E. of the island. This roadstead, which is sheltered from all winds from S.S.W. to E.N.E. (by the North), is perfectly safe during eight months of the year; that is, from the 1st of November to the 1st of July: but during the rainy season, the squalls from the S.E. are dangerous. The best anchorage for large vessels, in either season, is at the distance of 800 fathoms from the landing-place, with Cape Manoel bearing W.S.W. ¼ W. [*S.* 52° *W.*], a sail's breadth open of the North point of the island. At this spot there is a bottom of thick clayish mud, with a depth of 12½ fathoms, and it is convenient to weigh from, with the wind from any quarter.

To fetch the anchorage from Cape Verde, in the fine season, when the winds are from N.E. to N.W., it is necessary to run close by Cape Manoel and the South point of Goree; keeping by the wind on the larboard tack, and sounding until in 8 or 10 fathoms. When within a mile of the land, tack and beat up to the anchorage.

The above position assigned for the anchorage of this island possesses one very great advantage in the tornado season; which is, that if the ground-tackle cannot be depended on, a vessel may run before the squall and even be sheltered for a short time. For this purpose it will be necessary to veer to the end of the cable before the squall comes on, as its violence may not allow of a vessel being managed with the expertness requisite on such an occasion. She should then steer so as to round the North point of the island at a convenient distance, and when to the westward of this point, whatever may be the violence of the squall (which is always from the S.E.), the island will afford sufficient shelter to enable her to keep on the larboard tack until abreast of the South point. Having reached thus far, she will be in a favourable position for doubling Cape Manoel, as by bringing it to bear W. ¾ S. [*S.* 65° *W.*] she may then steer nearly four points free. All the channel between Goree and the Peninsula of Cape Verde is perfectly safe, having in it from 5 to 13 fathoms of water, and the shores may be approached within the distance of 200 fathoms. A vessel intending to remain any time at the anchorage should moor N.E. and S.W., as the two cables will then bear an equal strain in the heaviest of the squalls. Magnetic variation, in June, 1817, 17° 30′ W.

The Watering-place at Goree, and the Resources which this Anchorage offers.—The watering-place of Goree, used by vessels which frequent this island, is about 3,000 fathoms N.N.W. of the anchorage. It consists of several pits dug in the sand on the sea-side, near a marsh, and close to a negro village called *Han*. The water is neither agreeable nor wholesome, and should not be drank until it has been filtered, acidulated, or cleansed by red hot shot being put into it. The cove in which it is situate is exceedingly well stocked with fish, and hauling the seine will be attended with success, by any number of vessels touching here. Fire-wood is purchased from the negroes of *Dacar*, a little more to the West, at the rate of about twenty shillings the cord. Ballast may be procured at the foot of the point of that name. Small bullocks may be purchased from the neighbouring coast, for six or eight dollars each.

The whole coast, from Cape Manoel to Cape Naze, which forms Goree Bay, may be run along at the distance of 2 miles. One bank only lies at 800 fathoms E.S.E. ¾ E. [*E.* 3° *N.*] from Cape Belair,† having soundings which vary from 16 feet to 12 fathoms, with a bottom of muddy sand, or sand and shells, as far as the parallel of Cape Naze.

* Mr. Finlaison has said that ships sailing from the Cape Verde Islands, and bound to Goree, will strike soundings in 60 fathoms, fine sand, at 80 miles off.—Ed.

† This is, we presume, the *Cape Bernard* of the charts, lying to the northward of Goree.—Ed.

From the Bay of Han, northward of Goree, the coast rises a little at some miles in the interior, but it is exceedingly low at the sea-side, where it presents nothing but a white sandy strand. We again perceive the little downs, the chain of which joins the paps of Cape Verde, and which we ran along in going round the Bay of Yof. These downs rise progressively to the south-eastward, and are covered with trees as far as Cape Naze. This cape is terminated by cliffs of about 200 fathoms in height, the woody summit of which may be seen, in fine weather, at a distance of 7 or 8 leagues. In running along the coast toward Cape Naze, we pass successively several negro villages of the kingdoms of Cayo and Baol, belonging to Damel. The most considerable of these villages is *Rufisk*, on the eastern side of Goree Bay; then follow the anchorages of *Barnier*, *Red Cape*, *Yongop*, &c., all of which points are frequented by coasters from Goree, who trade for stock; they offer nothing interesting. The highest part of Cape Naze is in lat. 14° 31′ 30″ N., and lon. 17° 8′ 25″ W."—*(Roussin.)*

There are some rocks, westward of Rufisk, stretching about a gun-shot into the sea, which may be avoided by keeping half a mile from the shore. To the West and W.N.W. of Cape Naze is good anchorage, in 4 or 5 fathoms, fine sand; but to the South and S.W. of the cape the bottom, generally, is not good.

In the night time, you must proceed in 17 fathoms, having sometimes recourse to the lead; the land, even in the night, will direct you sufficiently to avoid the rocks. In the season of the tornadoes the road of Rufisk is not good; but in the summer, you may safely lie there in 6 or 7 fathoms, close to the shore, if agreeable.

About 3½ miles S.E. of the Red Cape lies *Cape Naze*, with a small bay between; from the latter the coast extends to the S.E. ¾ S. [*S.E.* ¼ *E.*] about 4½ leagues, as far as *Portudal*, formerly a French factory; and then 5 leagues S. by E. ¼ E. [*S.S.E.* ¾ *E.*] to *Cape Serene;* between this cape and Portudal, 2 leagues off the coast, and parallel to it, lies *Amboroo Bank*, on the South tail of which you find only 1½ fathoms. Ships that come from the westward must be cautious of this shoal; the ground is very hard upon it, and close to it is a depth of 5 fathoms.

To the S.E. of Cape Naze the land declines in height, and the downs are partially covered with bushes. The point near a little river, the *Soman*, is thus covered, and the country hereabout appears to be clothed with trees.

The village of Portudal consists of a number of huts on the shore. The coasters of Goree frequent this place. All the coast in the vicinity abounds in trees; and at 2 miles to the southward of the village is a small wood, very remarkable from its trees being much higher than the rest, and which, therefore, serve as a mark for the coast.*

The Road of Portudal is far from being good, and is fit for small vessels only; they lie close to the shore, athwart of the little houses between the cliffs. All the coast near Portudal is bordered with rocks, and must not be approached too near.

Three leagues S. by E. ¼ E. [*E.S.E.* ¾ *E.*] from Cape Serene lies JOAL or YOAL, standing on the North bank of a river of the same name, from which a shoal, with only 2½ fathoms of water upon it, projects into the sea. The Road of Joal is not much better than those we have just mentioned; the entrance of the river, between Joal Point and the point to the South of it, which they called *Palmarin Point*, is 3 miles broad, with a depth of 3 fathoms of water in mid-channel.

From Palmarin Point to the northernmost of the *Birds' Islands* the coast extends S. by E. [*S.S.E.* ¼ *E.*] 8 leagues; and, from the mouth of the Salum River, which lies 4 leagues south-eastward of the point, to the Birds' Islands, the shore is bordered with a sand, named the *Red Bank*, that stretches 4 miles into the sea, and close to which are 4 fathoms of water. The *Birds' Islands*, four in number, and very small, lie on this bank.

From Palmarin Point to the pitch of *Cape St. Mary* the distance is 11 leagues, South. [*S. by E.* ¾ *E.*] The entrance of the Gambia lies between the pitch of that cape and the low islets called the Birds' Isles.

In sailing off the coast between Cape Verde and the Gambia, shipping must proceed

* A more particular detail of this coast, and of all the shore between Cape Naze and Cape Roxo, by *M. Le Prédour* (extracted from the *Annales Maritimes*), was published at Paris in 1828. To the description is annexed a copious table of the positions of places, as determined in 1826 and 1827, on board the frigate *La Flore* and goelette *La Dorade*, under the orders of Captain *Massieu de Clerval*, which may be advantageously compared with more recent observations.

with caution, as the Amboroo Bank, the shoals of Joal, and the banks in the vicinage of the River Salum, are dangerous, being very shoal.

RIVER GAMBIA.—Between the parallels of 13° 30′ and 13° 40′, in an extent of 10 miles, is the estuary or mouth of the great River GAMBIA: it is bounded on the South side by a point named *Cape St. Mary*, the situation of which is lat. 13° 30′ 12″, lon. 16° 41′ 24″. On a point 6 miles S.E. by E. [*E.S.E.* ¼ *E.*] from this is the British settlement and new town of BATHURST.

The Gambia* is one of the principal colonies of the British on the coast of Africa, and the advantages of this noble river for carrying on trade with the natives in the interior were well known upwards of 230 years ago, for a company was formed in England for that purpose in 1618. From the time of the first voyager, Thompson, at that period, up to that of Mungo Park in 1795, it was considered that the Gambia and Senegal were branches of the Niger. Several expeditions were sent out, and the British Factory was placed on the small Island of St. James, about 17 miles from St. Mary's. Besides this settlement in 1724, the African Company had another factory at Joar, about 100 miles distant from St. James's Island. In 1688 the latter fort was captured by the French, and there is now scarcely a vestige of it remaining.

In 1816 a new settlement was formed at the Island of St. Mary's, which was formed on the faith of a treaty for the exclusive trade with the Gambia with the French. The Island of St. Mary's was purchased from the king of Combo; and on the opposite bank, a large tract of country, extending one mile inland, and about 36 miles long, was purchased from the king of Barra. It is to the eastward of Barra Point, and is of little advantage except as giving us command of the mouth of the river. There is no British establishment on this tract except Fort Bullen, immediately opposite to Bathurst, and a small house, the residence of a missionary.

In the vicinity of Cape St. Mary's, 7 or 8 miles to the southward of Bathurst, is a more valuable territory acquired by Lieutenant-Governor Huntley, in 1840, by purchase; it is called Baccow, and has some barracks for the African corps.

M'Carthy's Island is another British settlement, up the river at the distance of about 175 miles from St. Mary's, though this distance is usually called 300 or 250 miles. The island is about 5½ miles long and 1 broad, and the river is navigable up to it for vessels of large tonnage; beyond it the trade is carried on in small schooners; the breadth of the river here is about 200 yards. The falls of Barraconda, which stop the upward navigation of the Gambia, are about 300 miles above St. Mary's, and from this to Fort St. Joseph, or Gallam, the French settlement on the Senegal is about 150 miles, or five days' journey on foot. There are several islands on the Gambia, between M'Carthy's Island and the mouth.

The ISLAND OF ST. MARY'S is situated on the South bank of the river, opposite to Barra Point, where a battery has been erected, and where a few black troops are stationed; the breadth of the river here is about 2 miles.

The principal buildings on M'Carthy's Island consist of the barracks, the Wesleyan mission-house, school, and chapel, and three other stone houses; the population amounts to 1,200, or 800 males and 400 females.

The island is separated from the main land by a very narrow creek, called Oyster Creek; the length of the island is about 4 miles, and the extreme breadth 1 mile. The total population of St. Mary's is 3,514 souls, including 81 aliens and resident strangers; of the fixed population, 42 are whites and 3,291 coloured people.

BATHURST is situated in the Island of St. Mary's; it is a small, prosperous-looking town, with several excellent stone houses, especially on the wharf where the houses of the merchants are situated. Dr. Madden's report has given rise to much discussion as to the eligibility of the site of this town, but it would appear that there is no other situation which offers superior advantages. *Jillifree* is on the North side of the river, and is about half a mile from Fort James.

* We have taken this general description from the Report of the Government Commissioner, Dr. Madden. The correctness of that report was much disputed by many competent authorities, as will be seen throughout the evidence before the house, but we have omitted those portions which have been particularly specified. See Report on the Western Coast of Africa, Appendix, No. 8, p. 177, Part II., &c.

Albrida, or *Albradar*, is a fort belonging to the French, about half a mile from Jillifree, and their possession of this place is considered not to be on any well-founded claim, and is also a very serious inconvenience and injury to the British trade in the river.*

Of the Gambia, *Captain Belcher* says: "The Gambia, considered in a mercantile point of view, and as regards supplies, appears to offer more decided advantages than any of our possessions on the coast of Africa; and may, indeed, be said to be the only point where anything approaching to trade can be satisfactorily pursued. Even in its present state it is by far the most healthy part of the coast; and, had a portion of the liberality of government to Sierra Leone been extended to *Bathurst* and its dependencies, I feel satisfied that, long ere this, it would have acquired that character which eventually, with infinite labour, it will establish for itself from its own resources." The constitutions of the residents appear to be as sound as in any part of the world, and the strongest has been here thirty years without visiting Europe."

But it is to be regretted that, at Bathurst, the only fresh water to be had is from private wells; but, by close work in the dry season, as much as five tons a day may be obtained. Wood may be had at the beach, well dried, in convenient lengths for stowage, at a dollar and a half, or six shillings sterling, per cord.

CAPE ST. MARY is readily known by its making like a plain; low by the sea-side, with an acclivity toward the interior. It has some trees and one house upon it.

The narrowest part of the mouth of the Gambia is between the town of *Bathurst* and *Barra Point*, to the N.E., the distance between being only 2¼ miles.

From Bathurst Point, the Banyan or St. Mary's Shoal, a dangerous rocky shelf, extends 5 miles N. by W. ½ W. [*N.N.W. ¾ W.*] It is even with the water, on the ebb. At a mile to the N.E. of this is a bank called the *Middle Ground;* and, at three-quarters of a mile northward of the latter, is a smaller one, the *African Knoll.* There are from 4 to 6 fathoms of water between these banks; but the best way in is to pass to the northward of the whole, keeping over toward the Red Bank and the bank extending from the Barra or eastern shore, according to the following directions.

"It is strictly to be recommended that vessels, bound to the Gambia, should get into the latitude of 13° 40′, or 4 or 5 miles to the southward of it: then, making a due East course, keeping their lead going, until in 5 fathoms, when you may anchor, and engage a pilot. But, should you be desirous of proceeding up, you may follow the sounding depths of the chart; remembering that on the southern side of the channel the ground is hard; but on the North and East sides the lead sticks in, the bottom being of soft mud. The anchorage is off the town of Bathurst, with any part of it bearing about West, three quarters to half a mile off; the depth being 16, 14, and 12, fathoms. Small vessels may lie closer in, where there are 8 and 7 fathoms. The ground is good; the tides strong: but it is, altogether, a fine harbour."—*Lieutenant G. L. Harries, R.N.*

The direct course, from 5 fathoms off Bird Island Shoal, to within the African Knoll, off the edge of the Red Bank, is S.E. [*S.E. by E. ½ E.*] 5 miles, where there is, in the main channel, 6 and 7 fathoms. From the last spot to the anchorage off Bathurst, the course and distance, in a fair working channel, is S. ½ W. [*S. by E. ½ E.*] 7 miles.

When advancing to the Gambia, from the northward, you ought not to approach the river nearer than in 7 or 6 fathoms, before Cape St. Mary comes in sight. It may be advisable for a stranger not to proceed farther than in 5 fathoms without a pilot, unless the vessel draws less than 12 feet of water. Those leaving Goree, when bound to the Gambia, may steer about S. by E., keeping their lead constantly going, and approaching the coast no nearer than in 7 fathoms. When near the entrance of the Gambia, the ground will generally be found an oozy sand; but, near the cape, sometimes sand and sometimes red shells will be found. The ebb in the river runs very strongly, nearly eight hours, but the flood is not so strong. Spring tides are very rapid.

Having approached within one mile of Barra Point, from which a small spit stretches off to about a quarter of a mile, keep over for mid-channel between that point and Banyan or Bathurst Point. You have 8, 9, 10, and 12, fathoms between the two points, and good anchorage in 9 fathoms of water, muddy ground, with Barra Point bearing N.E. by N., and Banyan Point N.W.

* Parliamentary Report, 1842, vol. xi., Part I.: "Evidence of F. W. Finden, Esq.," p. 475.

The tide of flood sets to Barra Point, and the ebb directly on the Middle; be therefore very cautious during calms on an ebb tide.*

From Barra Point to Dog Island Point, on the same side of the river, the bearing and distance are South [*S. by E.* ½ *E.*] 8 miles. The coast between forms a deep and shoal bay, and the flats extend from it into the middle of the river. From Dog Island Point and Reef the coast takes a sudden turn to the S.E. and E.S.E., and it trends from Dog Island Point to *Lemaine* or *Lemon Point*, S.E. ¾ E. [*E.S.E.* ¼ *E.*] 2 leagues. On this shore, at half a league more eastward, is the French settlement at *Albreda*, and at half a mile farther is the English one named *Jillifree*. One mile south-eastward from Jillifree, on an islet in the river, is *Fort James*.

To go up to James Fort, which is 17 miles above Bathurst, you steer in mid-channel 2 leagues, with the town of Bathurst N. ¼ W. [*N.N.W.* ¼ *W.*] This leads to a fair offing from Dog Island Point. The course hence, in the fairway, to abreast of Lemaine Point, is S.E. ½ E. [*E.S.E.*] 6½ miles; and thence to Fort James, E.S.E. ½ E. [*East*] 3½ miles.

In order to avoid the shelf which extends from the Banyan or western shore, approach no nearer to that shore, in turning, than in 5 fathoms; nor near the Barra side, when above Dog Island Point, than in 4 fathoms; but if near that point, than in 6 fathoms. Lemaine Point should have a berth of a mile, as some shoals stretch from it. You may haul in and anchor before Albreda in 4 fathoms, half a mile from it, the ground shoaling gradually to within a cable's length of the shore.

After giving Lemaine Point a berth, do not haul for the Barra shore till you are abreast of *Albreda*, for the flat continues to the eastward of that point to a considerable distance.

Under Admiralty orders, in 1826, the River Gambia, to the distance of more than 190 miles, from its entrance, was surveyed by Captain *Richard Owen*, with his assistants, Messrs. Tudor and Mercer. This valuable survey exhibits the depths of water all the way up to *Pisanea*, where there remain the ruins of a factory, and where the tide, in the dry season, rises 3 feet. It appears from the survey that, at 3 miles above *James Fort*, this noble river is nearly 2½ miles in breadth. Here it takes a north-easterly direction, and thus extends for 10 miles, to a point on the South shore called *Moota Point*, and a creek, *Jukarda*, on the North. The depths of this reach, in mid-channel, are 5½, 4¾, 4¼, to 5, 6, and 7, fathoms. Pursuing thence an easterly course, its depths alternately shoalen and increase to a great distance.

From *Boonyadoo Creek*, or the Fourth River, which faces the mouth of the Gambia, to *Jukarda Creek*, above mentioned, is a line of coast, 1 mile (*nautic*) in breadth, and 42 miles in length, the sovereignty of which was ceded to His Britannic Majesty, by treaty with the king and chiefs of Barra, signed at Jillifree, 15th of June, 1826. A small spot (400 yards by 300) occupied by the French, at *Albreda*, excepted.

CAPE ST. MARY TO CAPE ROXO.—*From Cape St. Mary* (the true cape) the coast stretches 11 miles W.S.W. to the *Bald Cape*, where *St. Anne's Bank*, with the *Tongui Rocks*, extend about a league into the sea, and include three sandy islets, called the *Byjols*.

Upon the coast of Cape St. Mary the ground varies all along, but it becomes whiter to the southward: when past the cape you find a reddish sand, which, at 2 or 3 leagues more to the South, changes into a gray, then into a whitish, sandy bottom; and, about Cape Roxo, it becomes such fine sand as that which is put in the time glasses. These varieties of ground extend from 25 fathoms in the offing to 5 fathoms off the shore.

The coast between the Bald Cape and Cape Roxo, in a distance of 20 leagues, is very low, with a sandy beach, and covered with trees. The middle part is one low and continued forest, with clusters of large high trees, at a distance resembling islands.

In sailing between the two capes, by keeping in 5 or 6 fathoms along shore, you will find that depth down to the entrance of the *River Casamanza*, 4 leagues to the northward of Cape Roxo; there you have only 4 fathoms, and the ground mostly red sand.

* At the Gambia, in the season of the Harmattan, the rainy season had just terminated on the 9th of December. Upon this occasion the colours are hoisted and a gun is fired. On a second visit in May and June, 1831, the end of the dry season, symptoms of approaching rains, with squalls.—*Captain Belcher.*

About 2 leagues southward from that entrance, and abreast of a cliffy point, near which you may anchor, the ground is so clammy, about a musket-shot from the shore, in 2 fathoms of water, that the lead is brought up with difficulty.

The ENTRANCE of the RIVER CASAMANZA is situate about 16 leagues to the southward of Bald Cape. If a bar did not obstruct this entrance, the river might be navigated by frigates; but it can be gained only by a very narrow channel, having a depth of 2 fathoms.

The Portuguese, established on the healthy and fertile banks of this river, have ascended to the distance of many leagues from its mouth; they have several establishments on it, the principal of which are called *Zinghicor* and *Makia Kaconda*. They have carried on an advantageous trade, especially in ivory, rough hides, aromatic seeds, and woods for dyeing, with the Feloop and other negroes, who inhabit the banks of the river.

There is now a French establishment at the mouth of the Casamanza, on the northern point. Toward this there are two passages, divided by the bar, which extends outward, to the West, nearly 4 miles. The deepest channel is on the South side of this bank, and has 3½, 6, 4, increasing to 8, fathoms off the point. The river upward, which has a serpentine form, has been surveyed by Captain Boteler; and from his survey it appears that there is another French settlement, the Factory of *Berrin*, at 10 leagues up the river on the South side, and 3 leagues below Zinghicor, which is on the same side. The soundings in mid-channel, from the entrance to the latter place, vary from 8 to 4, 6, 3½, 5, 6, 3½, 8, and 5, fathoms. The French recently placed another establishment at *Sejeu*, having purchased the land of the natives, and they are apparently endeavouring to increase, as much as possible, their commerce in this part of the world.*

CAPE ROXO (lat. 12° 21′) is improperly called a *cape*, it being an obtuse point of *low land*, from which the coast takes an E.S.E. direction to the *River Cacheo*, or *Rio San Domingo*, the navigation to which is impeded by extensive shoals called the *Cacheo Banks* and *Falulo Breakers*. The point or cape, when bearing E.S.E. or East, presents a down of white sand, of moderate height, covered with brambles. On one side of the points formed by the coast to the northward are a number of tufts, of a remarkably red colour, and it is supposed that, from these tufts, the name of *Roxo* (Red) has been imparted to the headland, although they are distant from it about 2½ miles.

M. Roussin says that on all the approaches to Cape Roxo the soundings are regular, but the depth inconsiderable. From the River Casamanza, to the distance of 2 or 3 miles from shore, there is a depth of only 6 to 4 fathoms. At 10 miles to seaward are 8 and 7 fathoms; and at a short distance to the S.S.W. the first bank of the Bissagos is met with.

CACHEO, on the South bank of the river of that name, has been the chief Portuguese establishment between Cape St. Mary and Cape Verga, and was, formerly, very considerable. They carry on the same kind of trade here as at Casamanza. The country is singularly fertile and well peopled.

The mouth of Cacheo River is about 6½ leagues to the south-eastward of Cape Roxo, and the entrance is between two reefs. In proceeding for it, give Cape Roxo a berth of about 5 miles. Steer S.S.E. on soundings of from 4 to 5 and 6 fathoms, on a sandy bottom. Go close to the eastward of Cacheo Bank, which has 2½ fathoms of water on it. Continue S.S.E. until you see breakers ahead, and run straight for them, until you are in 5 fathoms of water. You will see a single tree bearing East, then steer E. by S., leaving a reef, which extends out about 4 miles from that tree, on your larboard hand: this reef, although it is said to have 2 fathoms on it at low water, breaks at half tide. Close in to the beach, at the tree, there is a passage of 2½ fathoms, which is fit for small craft only. Continue your course E. by S., when you will be apparently 4 miles from the land on your larboard hand, and will come to a shoal called the *Mud Bar*, on which there is a depth of only 18 feet at ordinary high water, but is only soft mud, and about 2 cables' lengths in breadth. You may then see a clump of palm trees (ten or twelve in number), bearing E.N.E.; and when these palm trees bear N.E. by E., you will be over the bar, and will have from 5 to 6, 7, 8, and 9 fathoms up to *Cacheo Fort*, by keeping in the middle of the river; and, when abreast of the Fort, which belongs to the Portuguese, anchor in the middle of the river in 9 fathoms.

* See *Parliamentary Report*, Part I., pp. 475, 657, 699, 700.

BISSAGOS and BIJOOGA ISLANDS.—We have now arrived at the Archipelago of Bissagos and the Bijooga Islands.

This archipelago is an extensive assemblage of islands and shoals between the parallels of 10° 42′ and 11° 40′ N., and between the meridians of 15° 30′ and 17° W. Of the interior navigation among the isles little is yet known, and the hostile disposition of the inhabitants, as recently manifested, renders it probable that no complete survey of it, at least in the present age, can be made.

The principal isles that constitute the archipelago are said to be 16 in number, besides many islets, all surrounded by shoals, as shown on the chart.*

The archipelago is bounded on the North by the JEBA CHANNEL, or GREAT CHANNEL of BISSAO; and on the East by the CHANNEL of RIO GRANDE. These channels were partially surveyed by the officers under Captain Roussin, in 1818, and Captain W. F. Owen, in 1826; and to their surveys we owe our knowledge of the navigation presently to be explained. The southern breaker, called that of the *Bayadère*, was discovered in 1818, and is represented by M. Roussin in lat. 10° 42′ 56″, lon. 16° 17′, and the mouth of the Eastern or Rio Grande Channel is 7 leagues more to the eastward.

JEBA CHANNEL or CHANNEL of BISSAO.—The main land, forming the North side of this channel, is intersected by several rivers, which divide it into islands. The first of these is *Cacheo*, then follow *Jatt*, *Bassi*, and *Bissao*, of all which the land is low. But there is, near the S.W. end of Jatt, at 13 leagues S.S.E. [*S.E.* ½ *S.*] from Cape Roxo, (lat. 11° 50′) a small but conspicuous isle, named *Cayo*, which is bold-to, and very useful as a sailing-mark. This isle, when on an easterly bearing, appears like three isles, but, on nearing, will be found to be connected with a flat, which is common to all, though intersected, at high water, by shallow lakes. Its soil is sandy, and mixed with flinty rock. The beautiful trees with which it is covered may be seen, in clear weather, at 4 or 5 leagues off. At 6 leagues more to the eastward [*E.S.E.*], off the S.E. end of Jatt, are several islets, called the *Ancoras*, which distinguish the western side of a river, bearing the same name.

The islands, generally, which border the Jeba channel, are not high. The beach is generally of white sand, interspersed with black and red rocks, which, being covered with lava, are, doubtless, with the whole archipelago, of a volcanic origin. They are all well wooded to the sea-side; and the height of the trees, with their vigorous appearance, indicate that the soil must be fertile. The Island Bissao, on which the Portuguese are established, is not so thickly wooded as the others; but this is owing to the clearance they were obliged to make for their safety, as the isle is equally fertile as the rest. The large isles of the archipelago are inhabited by a race of negroes, known in the country by the name of *Papels*.

On the Rio Grande, the Portuguese have several establishments. The settlements of Portugal, on the coast, do not extend beyond Cape Verga. The objects of trade consist chiefly in elephants' teeth, wax, hard soap, rough hides of every kind, dyeing and building wood, indigo, cotton, drugs, resin, and resinous gums, gold in small quantities, orchilla, &c.

The extremity, or N.W. part of the Bissagos Shoals, is composed of hard sand. From this extremity, the bank and isles extend to the southward and south-eastward, 23 leagues, toward the Eastern Channel of the Rio Grande; and the flat, which is from 12 to 6 leagues in breadth, is interspersed with banks above and under water, and islands, either dry, or drowned and marshy, the detail of which is little better than unknown.

On the 25th of December, 1789, the sloop *Endeavour*, of Liverpool, struck on the N.W. end of the shoal, to the westward of the island named *Carasche*, in lat. 11° 38′. Captain S. Gamble, who was a passenger in the sloop, says, in his journal, that she got over the reef, but, not being able to find a passage through the shoals and islands, was, after twenty days' search, obliged to return the same way she went in, and carried 3 fathoms of water over the bank. All the islands they saw were inhabited, but the natives did not appear to have any canoes, and the few which they persuaded to come on board, in hopes of finding a pilot among them, became seasick. When the vessel struck, Carasche bore E.S.E. about 4 leagues; and when she was near the northernmost point of that island, the isle or kay, called Isle Cayo, on the North side of the Frith, bore N.N.E.

* For the positions, see the Table, page 48.

The North edge of the Shoals of Rio Grande, adds Captain Gamble, is in lat. 11° 40′, and we led round them in 11° 43′, carrying from 11 to 15 fathoms. The tide of ebb runs very strongly over the flats to the S.W.; and, within the heavy breakers, the ebb runs W. by S., and the flood, E. by N. The tide, at full and change, rises 12 feet.

The PASSAGES TO and FROM BISSAO.—Cape Roxo has already been described. Should you fall in with this point in the evening, come to an anchor, bringing it to bear North, as then you will be well laid, in order to proceed farther.

The outer part of the *Breakers of Falulo* bears S. by E. [*S.S.E. ½ E.*] 17½ miles from Cape Roxo, and lies to the south-westward of the River Cacheo. The breakers are divided into two groups, and extend in a *true* E.S.E. and W.N.W. direction 3 miles. They are very steep-to, and close to them are from 6 to 3 fathoms. A merchant-vessel may advance within sight of them, and thence proceed toward the Isle Cayo: but the best way of proceeding to the Jeba or Bissao Channel is as follows:—

From a point at 2 leagues to the westward of Cape Roxo, proceed S.W. by W. ½ W. [*S.W.*] 12 miles; then haul up on the larboard tack, as at this distance the depth increases. The next course will be S. ½ W. [*S. by E.*] for 25 miles, which will bring you to the parallel of 11° 47′, where a depth of nearly 50 feet, with a muddy bottom, will be found.*

You now enter the Channel of the Jeba, and will find, that a run of 12 leagues, E.S.E. ½ E. [*East*] will lead to the South point of the Islet *Cayo*, the trees of which, as we have shown, may be seen at a considerable distance. All the space to the northward of this track is replete with banks, which extend to the main shore; but those of Falulo are the only ones that break incessantly.

Proceeding thus, the depths will be found always regular, from 7 to 8 fathoms, and the bottom constantly of mud. It must be observed, that when entering the Great Channel, the northern banks should be approached in preference to the southern. As the former descend by a gentle declivity, they always warn a vessel when she is out of the channel, by each cast of the lead giving a gradual decrease of depth. The southern banks, on the contrary, are extremely steep; close to a depth of 40 feet there will be found one of 25, on a bottom very unfit for anchoring.

In order to be assured that you are keeping the channel, keep constantly sounding, and observe, that in all the channels which separate the banks to the N.W. of the Bijoogas, the bottom is almost exclusively soft mud without any mixture. At each cast, therefore, when the lead sinks into the ground, you may be certain that you are following the proper channel, and the middle of it may be found, by the lead sinking deeper, and being less easily extricated. If the bottom becomes hard, it is a certain proof that you are near some bank, and if the vessel has much way on her, she must alter course directly for that side on which the bottom is softer.

A vessel seeking or running for the anchorage off the Islet Cayo need not mind passing close to it. This part is perfectly safe to the beach, at half a mile from which there is a depth of 8 fathoms, on a soft muddy bottom.

The Great Channel, on the meridian of the Islet Cayo, is about 4 leagues in breadth; but this space is divided into three channels, by means of two banks, on which there is very little water. Of these banks, the northernmost is the *Bank of Cayo*, having a depth of only 10 feet on it, and lying 4 miles to the southward of the islet of that name. It is rather narrow from North to South, but its length from East to West is about 5 miles. The best of the three channels is to the northward of this bank, in which there are from 7 to 9 fathoms.

At the distance of 2 miles southward from the Cayo Bank is the *Bank of Carasche*, which breaks continually, and a part of which is dry at low water. Like the first, it extends *true* East and West, and its length is also about 5 miles. The least depth between the two is 9 fathoms. At 4 miles to the southward of the Bank of Carasche is the North point of the island of the same name, which forms part of the South Bank of the Great Channel. There is a channel between the bank and the island, but the depth is irregular, and the bottom is bad.

* Vessels coming from the northward, after making Cape Roxo, may steer S.W. from that cape, in 8 fathoms, all along, until they catch from 10 to 12 fathoms, green ooze; then steer S.E. by E., taking care not to get into less than 6 fathoms on the larboard hand on Cacheo Bank, &c.—*Mr. Swann, a pilot.*

On advancing for the Portuguese establishment at Bissao, and having arrived to the eastward of the two banks before mentioned, you may safely proceed 5 leagues S.E. ¼ S. [*S.* 60° *E.*], and will thus coast the Island of Jatt to its S.E. point, which, from the trees upon it, appears to be the highest part of the whole coast on the northern side of the channel. The course thence is E.S.E. [*E.* 5° *S.*] 6 leagues, in which extent the *Ancoras*, situated to the S.E. end of the Island of Jatt, the channel between that island and Isle Bassi, and the southern part of the last island, will be passed successively to the northward: on the South you will cross a large bay formed by the Islands *Carasche* and *Corbelle*, will pass the Parroquet Island [*Papakawa*], lying to the eastward of the latter, and finally arrive on the meridian of the western point of the Island of Bissao, at about 3 miles from it. From the Parroquet Isles, the southern side of this channel is formed by a bank, several parts of which are dry at low water.

To the southward of the town of *Bissao* is an islet, called *Bonn;* and at 2 miles above this is another, called *King's Isle*. On the South side of the river is another called *Arcas*, which is 7 miles from Bonn, and nearly on the same meridian. The latter lies on the eastern side of the channel to Rio Grande, and is the distinguishing mark for that channel. From the S.W. end of the Isle Bissao the course to Bonn is E. ¾ N. [*E.* 20° *N.*] This course runs parallel to, and within 2 miles of, the Island of Bissao, and passes over several patches, on which there are only 26 feet at low water. These patches are to the northward of the eastern channel, the mouth of which is near the Island of Arcas, which is seen at the same time. They may be avoided by altering the course occasionally; but as the depth on them is not less than 26 feet, and does not experience any considerable rise, as they are of no great extent, a vessel may pass over them without any fear, and may shape a direct course.

At 3½ miles W. ¼ S. [*W.S.W.*] of Bonn, is the *Point* and *Grove of St. Martin* of Bissao, where the coast forms a slight elbow. This point is not to be approached with safety, nearer than 1½ miles by a large vessel. At 3 miles S.S.W. [*S.* 5° *W.*] of this point, and in a continuation of the line from Bonn to the highest point of King's Island, lies one of the knolls above spoken of. It is the easternmost to be met with on the course above stated. To the eastward of the meridian of Point St. Martin, the depth increases toward Isle Bonn. This knoll, with 26 feet of water on it, is a small bank of not more than 100 fathoms extent in every direction, having deep water to the northward and southward of it.

When a vessel is within 3 miles S.S.W. ½ W. [*S. by W.*] from Bonn, she should steer direct for it, so as to pass within 200 fathoms to the eastward of the island. This part is extremely steep, having, at the above distance from it, a depth of 8 fathoms. From hence she should run between King's Island and the Fort, and anchor in 6 to 8 fathoms, on a soft muddy bottom. Having doubled the Isle Bonn, the coast of Bissao should be approached nearer than King's Island, as the depth is greater, and varies from 6 to 7 fathoms. It would be superfluous to mention the necessity of sounding constantly in this internal navigation.

BISSAO.—The road of Bissao lies in the principal stream of the River Jeba, between the eastern side of the Island of Bissao and the small island opposite, called King's Island. This roadstead is perfectly safe in all weathers. It is so completely sheltered, that the sea is always smooth; and the bottom is of such a nature that with good ground-tackle a vessel may ride there in any season. It is advisable to moor N.E. and S.W., as the tides set in this direction: and in the rainy season, as the squalls come from the S.E., the anchors, being thus placed, will bear an equal strain.

The Portuguese Fort stands at 100 fathoms from the beach, and is a square redoubt, flanked at the four angles by a bastion. The wall of the ditch, which on each face is about 100 paces in length, may be about 30 feet in height. The magnetic variation observed in April, 1818, at the anchorage, was 17° 30′ W.

The watering place at Bissao is on the beach, at about 300 paces to the southward of the Fort. It consists of several pits, dug about 4 feet deep in the sand, and may afford sufficient water to fill thirty casks in 24 hours. This water before being filtered, coming from sand and rock, is not agreeable to the taste, although it has the reputation of being wholesome, and of keeping well; nevertheless it should not be drank without being previously acidulated, or purified by red-hot shot. It may be either brought on board in boats, or rafted off at high water.

Independent of wood and water, excellent bullocks, of about one hundred weight, at

the rate of from twenty to twenty-five dollars each, have been had at Bissao; also goats, pigs, and poultry. There is also rice, maize, and yams, and some fruit, such as bananas, lemons, and oranges. These articles are exchanged for gunpowder, brandy, iron, clothing, and dollars, by applying to the governor.*

The waters which surround the Bissagos are far from being supplied with fish, and it is erroneously affirmed, in some works on Africa, that amongst these islands cargoes of salt fish may be procured. Mud prevails too much in the bottom; and the few fish which are found are not even considered as wholesome. No dependence can be placed on this resource, between the Gambia and the Isles de Los.

Dr. Madden says, " Bissao is the great stronghold of the Portuguese slave trade. The island of this group, on which the Portuguese Fort and factory are established, is situated at the mouth of the River Jeba, about 100 miles South of the Gambia.

" This island is about 5 miles in length, and 2 in breadth; the Fort is dilapidated, but of considerable size, and commands the entrance of the river. The guns are in an unserviceable state.

" Formerly the trade in slaves at this place was very considerable, and still is carried on to a great extent by the Portuguese, aided, so far as the supplying of the slave-trade factories with their goods and stores, by our own traders.

" The Portuguese Government officers, the governor himself, and the settlers at Bissao, are all concerned in the interests of this trade. There is a considerable trade carried on here on the part of the merchants of the Gambia and the Senegal in wax, hides, and rice, and a very large portion of the produce shipped from the Gambia, and inserted amongst its exports, is brought from the River Jeba."

Winds in the Great Channel of the Bissagos.—The winds here follow nearly the direction of the land, and vary their course according to that of the channel. In the Great Channel they vary from West to North; at the anchorage of Bissao they are generally from S.W., except in the morning, when they are from the northward. In the rainy season, which commences here in the beginning of June, and continues about five months, they blow from the S.E. with the tornadoes, as on the whole coast, and then, passing round by South, return to the northward. Whatever may be the direction of the wind, a vessel, with the assistance of the tides, may always find her way into or out of the Great Channel, and the working is extremely easy with the assistance of the new Chart, which should accompany these Directions. The remark, respecting the northern bank being approached in preference to the southern, should be attended to here; the islands to the northward being perfectly safe, whilst those to the southward are surrounded by very steep and hard banks. Large vessels should not approach nearer to the Isle Corbelle than 3 miles, nor to the line which connects it with Isle Carasche. All the space which lies between the islands, to the southward of this line, is filled with banks, having little water on them, and the greater part of which lie in the channel. If it should fall calm, and it be wished to let a vessel drift with the tide, she must not be abandoned to it until she has opened the channel she intends entering.

Anchorage in the Jeba or Great Channel.—A vessel may anchor anywhere in the Great Channel, the bottom being of soft mud and excellent holding-ground, with the exception of one place at 2½ miles to the southward of the Isle Jatt. Here the depth is from 20 to 22 fathoms, and the bottom of coarse gravel. In all other parts of the channel the depth varies from 13 to 6 fathoms, without any sudden alteration.

TIDES.—The usual prevailing currents on the coast to the northward of Cape Roxo are found to be completely changed on passing this Cape. They have here no longer one only direction; and, in all channels of the Bissagos, are suspended by tides, which are more or less regular. Those in the Jeba or Great Channel are perfectly so. Westward of the Isle Cayo the flood sets S.E. and the ebb N.W., each six hours, or nearly so, with the exception that the current gradually assumes these directions, requiring nearly

* Bissao appeared to have declined very much. Captain Owen says, that it is an excellent and spacious port, and " some bullocks, with *difficulty*, were obtained here." It is stated that there is now but little legal trade at Bissao, and that the slave-trade is the principal branch now carried on here. Since the destruction of the barracoons at the Gallinas River, by Commander Denman, in 1840, this place has experienced a considerable increase in the exportation: the factories at Bissao are principally supplied by English vessels.—(See *Parliamentary Report*, Part I. pp. 374, 381, 405, &c.)

an hour, from the change, before it is completely settled in its course. The flood generally sets to the northward, and the ebb to the southward. The greatest difference which has been observed between the high and low water marks, is 8 feet; and at the equinoctial full moon the rate of the flood and ebb is about 1¾ miles an hour; at other times it never exceeds 1 mile. At the entrance of the Great Channel, which is 6 leagues to the westward, and on the parallel of the Island of Cayo, it is high water, at full and change, at 9^h 15′.

From the meridian of Cayo, and as far as that of the Isle Bonn, the stream follows the direction of the channel; and here the tides are regular. It is not known that the length of the ebb exceeds that of the flood. The greatest rate of either never exceeds 2½ miles per hour, in spring tides, and the rise is found to be 8 feet, as outside the channel.

On the meridian of Cayo it is high water, at full and change, at 11^h. Before Bissao the rate of the highest tides never exceeds 2·6 miles per hour, and the rise is never more than 14 feet. In common tides the rate is never more than 2 miles per hour, and the mean rise is 7½ feet. It is high water, at full and change, at the anchorage of Bissao, at 12^h 30′.

CHANNEL of the BOLOLA, or RIO GRANDE.—The eastern channel, or Channel of the Rio Grande, branches into the Jeba Channel to the westward of the Island Arcas. The western bank is formed by a flat, which extends to the eastward of the Parroquet Islands and *Isle Galinha*, the banks which connect these with the *Hog Islands*, and by *Kanyabac Island*. The eastern bank comprises the *Isle Arcas*, *Bulama* or *Boolam Island*, and the banks which connect these two islands. It is then intersected by the mouth of the *Bolola* or *Rio Grande*, after which it again commences at Bossessamé, and forms a chain of reefs as far as the Island Yomber, in 11° 3′ N., and 15° 40′ W.

The channel is then divided into two branches by a bank, which is about 4 leagues in extent from North to South, and on which, amongst several islets and breakers, are situated *Isle Cavalho* and *Honey Island*. Seven miles to the southward of the latter lies *Pullam Island*. The western or main branch has, on its western side, the *Island of Orango*, and a long chain of reefs, which extend S.S.W. from that island.

To enter from the northward.—The first difficulty which presents itself, on entering this channel from the *northward*, is when passing the Isle *Arcas*. From the S.W. part of this island a bar stretches out, on which there is a depth of only 19 feet at low water. It is terminated, at the distance of 4 miles, by a rocky bank, which also forms a part of the bar. Although the depth may be a little more at the distance of a mile from this bank, a large vessel should not venture near it without previously considering well the time of tide. If she be obliged to anchor, the best ground will be found near the meridian of Arcas, on the North.

The mark for running through this Channel, from a position bearing W. ¾ S. [*W.S.W.*] from the Isle of Arcas, is to steer so as to keep the western point of the Island Bulama constantly bearing South [*S. 17° E.*], until within 2 miles of the shore of this island. From hence, if it be intended to go to the southward, a vessel should steer for the middle of the strait formed by this island and Galinha; but should a vessel be bound to the northward, she should steer N. by E. ¾ E. [*North*] from the above bearing of Arcas, until she has passed the parallel in which it lies.

BULAMA, or Boolam.—The western end of this isle may be approached within a mile. This island, which is well wooded and of moderate height, has several well sheltered roadsteads, which afford safe anchorage. One of these, on the S.W. side of the island, has a depth in it of from 22 to 24 fathoms, with a bottom of soft mud. The configuration of the land is such, that the strength of the current, being carried more to the southward, is almost imperceptible at this anchorage; and although the tide rises from 12 to 15 feet, the sea is generally smooth and the land ingeasy. At this roadstead fresh water may be procured from two places.

Bulama is generally considered as very fertile. Its situation at the entrance of the Rio Grande, which may be navigated to a considerable distance, the facility of its approaches from the westward and southward, and the safety of its anchorages, render it one of the most important islands hereabout. It is situated in the same estuary as Bissao, and about 30 miles to the southward of it. It is claimed both by British and Portuguese, and by the former, in right of a treaty for its purchase entered into with the natives

by Captain Beaver. The Portuguese claim a prior possession to that of Captain Beaver's purchase, which, they say, was made from a chief who had no right to sell the island.

The island, however, on account of its insalubrity, was abandoned for many years by both; till one of the slave dealers of the Havannah, a Senor Gaetano Nozzalini, obtained a Royal Portuguese Charter for settling on this island; and, in 1829, he established himself there. During ten years the island was in the hands of Nozzalini, it was frequented by slave dealers. But, in December, 1838, Lieutenant Kellett, of H.M.B. *Brisk*, visited the island, attacked and destroyed the factory, and carried away 119 slaves, and subsequently carried away another batch of slaves, which the owner asserted were his domestics, notwithstanding the fetters with which they had been manacled were found amidst the ruins of the barracoon.

In 1840, Lieutenant Hill, of the *Saracen*, had an interview with the governor of Bissao, on the subject of the occupation of Bulama by the Portuguese, and threatening to expel by force any Portuguese subjects he might find on the island. The governor of Bissao repaired to the Cape Verde Islands to complain to the Portuguese Governor-general of the threatened dispossession of the Portuguese, and the matter is still undecided.

This island is now of little value to the Portuguese, and might become, in our possession, of importance, as a refitting station for our cruizers, and a depôt for coals for East Indian, or cruzing steamers on this coast. The merchandize supplied to the slave factories at Bissao by our traders is usually paid for either in money, or by bills drawn by the Spanish merchants, at the Havannah, or London houses. Its proximity to Bissao, the Rio Grande, and other slave trading localities, and the great advantage in the suppression of this traffic, that would ensue from the introduction of legitimate trade, adds materially to the importance of our possession of this island.*

From the western point of Bulama the course is S. by E. ¾ E. [*S.* 36° *E.*], the distance 3½ leagues. This course crosses the mouth of the Rio Grande, which separates Bulama from Bossessamé; continues along the banks to the S.E. of Galinha, at the distance of a mile, the greater part of which are dry at half-tide, and extends to about 1½ miles from the banks on the western part of Bossessamé. The soundings on this track are very irregular, and vary from 35 to 8 fathoms, with a bottom, generally, of sand and gravel.

When at 2 miles to the westward of Bossessamé, a vessel may run for Kanyabac Island, steering South 3 leagues. The depth in this course varies from 7 to 20 fathoms, red sand and shells. To the westward of this track are the four little islands called the *Hog Isles*, and in the country, *Rouban*, *Banak*, *Chiveya*, and *Corett*. The latter, which is the northernmost, is the most remarkable, being covered with large trees.

KANYABAC.—All the eastern side of Kanyabac is perfectly safe, and may be approached to within a mile, in from 6 to 10 fathoms. The S.E. point, which the inhabitants call *Barel*, is about 60 feet high, very bold, and formed in peaks. On rounding this point to the westward there is a small cove, called by the inhabitants *Port Manel*. It has a very good bottom for anchoring, but at low water a very small depth. This part of the Eastern Channel is formed by the S.E. coast of Kanyabac Island on one side, and a continued chain of banks, on which the sea breaks, on the other. The latter connect Bossessamé and Yomber Islands, and have on them an islet of white sand.

Kanyabac Island, one of the most considerable of those which form this channel, is of a moderate elevation, and rather higher on the southern than northern end. It presents alternately a sandy, volcanic, and ferruginous soil. If we may judge from the numerous population, and the quantity of cattle on it, this island must be very fertile.

The large trees, called in the country *Pullam Trees*, with palm trees, and vegetables of all kinds, are very plentiful on it.† The Port of Manel, lying between Point Barel and an islet called *Pomp*, seems to be the chief resort of all the canoes belonging to the inhabitants of the southern part of the island.

* Dr. Madden's Report, &c.

† Captain Belcher has noticed that the Pullam tree is the *bombax* or *silk-cotton tree*, and has no reference to the palm. *Pullam Island*, which will be presently described, as deriving its name from the "large trees with which it is covered," can hardly boast half a dozen palms, which hide their diminished heads beside the more majestic *Pullam trees*.

From *Point Barel*, near the middle of Kanyabac, the course is S.W. ¾ S. [*S. 30° W.*] 13 miles. This will take a vessel within 2 miles of the western side of a very extensive bank which lies to the northward of the Isle Cavalho. The depth on this course is from 10 to 21 fathoms, the bottom of sand and shells.

From 2 miles West of the banks to the northward of Isle Cavalho the direction of the southern parts of the Channel is S.W. ¾ S. [*S. 30° W.*] This bearing, extended to a distance of 13 miles, will pass the eastern shore of Orango Island, at a proper distance, and also breakers which stretch more than 2 leagues off to the S.W. of this island, and to the parallel of Pullam Island, at 3 leagues from it. Orango Island is the most considerable of the Bissagos. From hence, any course between S.S.E. and S.W. by W. [*S.E. ½ S.* and *S.W. ½ S.*], will lead a vessel perfectly clear of all danger, and out to sea.

The eastern part of Orango is not very high, and is of the same nature as the adjoining islands. The most conspicuous point, when bearing N.W. by W. ½ W. [*W. by N.*], is a well-defined cape, much higher than the adjacent land, and remarkable from several spots of yellow sand, which form a striking contrast to the brown appearance of the coast. This cape, forming the S.E. point of the island, is called *Cape Cameleon*, or *Yellow Cape*. At 4½ miles to the East of it is a spot nearly dry at low water; but the depths between are from 5 to 11 fathoms.

Pullam Island, which derives its name from that given by the natives to the large trees (Bombax) with which it is covered, has not above a mile of extent in any one direction, and is very little above the level of the sea. Its shores are rocky, and rendered very difficult for landing, by the constant surf which breaks on them. It is impossible for large vessels to approach this island; from S.W. to E.S.E. it is bounded by flats, which extend to a distance of 4 miles from it, several parts of which are dry, or breaking.

On the 21st of April, 1821, H.M. ship *Leven* arrived off the Bijooga Islands, and anchored between Yomber and Orango. Upon the latter many natives and herds of cattle were seen. On the following day the *Leven* grounded upon the shoal, at half a mile from the East shore of the Isle *Bawack*, between Canyabac and Orango, where she lay in a perilous situation until the next tide, when she happily got off. On anchoring, many canoes came off, with natives bringing various articles to exchange for tobacco; but they had been reported as ferocious, dishonest, and treacherous; and they were found to be so.

The natives are savage, both in appearance and disposition. Their dress is composed of a single goat-skin, fastened tight round the loins. They are ornamented with cowrie-shells, and wear numerous *gregories* (gris-gris) or charms, suspended round their necks, consisting of boars' tusks, antelopes' horns, bullocks' teeth, cone shells, and beads. Tobacco, knives, and razors, were the only articles they would receive in barter; and one striking and novel trait in their character is, a great antipathy to rum. For a large fowl they demanded a handful of tobacco, and for a bullock not less than a musket. Their canoes vary from twenty to forty feet in length, three to five broad, and about three deep, with projecting head and stern; the bottoms being composed of one piece of wood, are consequently much mis-shapen by the irregular growth of the tree. Their paddles are six feet long, broad and clumsy; a term which is equally applicable to their use of them, as they make but little progress through the water.

Information was gained, that on *Kanyabac* there are many villages, each subject to its own king or chief; and that the elephants, which are very numerous, in their efforts to procure water, dig neat wells with their feet, which, as there are no streams, the people preserve. The country on the right bank of the Rio Grande (Bolola) is called by the natives *Gwinara*, and not *Ghinala*, as usually written. Its chief productions are ivory, gold, wax, hides, and horses, which they readily exchange for iron bars, cutlases, fire arms, and ammunition. It is populous in the interior, and has a mercantile establishment, that of a Mr. Lawrence.*

The banks of the river have the appearance of being thickly inhabited, but the huts with which they are apparently studded are, upon a nearer inspection, discovered to be ant-hills, which are built in exactly the same form, and of the same height.

On the island *Galinhas* (*Hen's Isle*) the tracks of elephants and hippopotami were seen; and the largest sized boa-constrictor is also frequently seen in this island. The natives

* For some account of this person, see *Captain Owen's Narrative*, vol. i. p. 257.

have great respect for these reptiles, and imagine that whoever destroys them will die himself. This island resembles Bulama in every respect, having fine savannahs and abundance of water; both are surrounded by an extensive flat, which renders landing exceedingly difficult at any other period than high tide.

The idea we had been led to form of these islands was extremely erroneous; as instead of being "low and marshy, with scarcely a channel for boats between their muddy shores," we found them a cluster of the most beautiful, fertile, and inviting islands, with moderately high and bold shores, separated by deep water, and containing many fine harbours; most of them being inhabited, and each village having its independent ruler. According to the customs of these people, every vessel stranded upon their shores is forfeited to the chiefs or people, in consequence of which they considered that they had a just claim to the Leven, when she lay grounded near Bawack.

It is a practice of these islanders to rear their poultry and stock on the small islets, some abounding only in fowls. The natives of Kanyabac breed cattle on Yomber, and horses on Honey Island, which the people of Bissao called *Yalka-valayo*, being a corruption from the Portuguese Ilha-Cavalho. Galinhas appears also, by its name, to have been used for raising poultry; and many of the islets do not contain twenty acres of ground, yet are well wooded and fertile, with some stock on most of them.

In 1832 these islands were visited by Captain (now Sir Edw.) Belcher, who has also described the repulsive habits of the people. No bullocks, though numerous, could be obtained otherwise than for arms and powder. The whole of the islands, he observes, are of volcanic origin. Yomber, Honey, and Cavalho, are at times inhabited, but Pullam is not. On all, except Orango, vegetation appears to be luxuriant, but the very sandy nature of Orango renders it impossible. Fish are abundant throughout, but rocks quite as much so. On Pullam are some poisonous roots, which should be touched with caution. The plant has a lily stem and flower, and is shaped something like a turnip; another has the bulbous root of the lily.

A more circumstantial description of the islands and inhabitants, by an officer of the *Ætna*, is given in the *Nautical Magazine*, No. 12, page 82, and No. 14, page 206; which, in conclusion, remarks that the principal feature in the character of the people is avarice, which can be gratified only by the possession of whatever they see. During the last forty years they do not appear to have advanced one step in civilization, and their treatment of strangers, with the difficulty of access to their islands, will long perpetuate their barbarous condition.

"In justice to them, however, it must be observed, that there is too much reason to believe that they have not always been treated fairly by the few white people with whom they have had intercourse: and there is little doubt that their history would discover much that might be adduced in extenuation of their singular manners."

WINDS, &c., *in the* EASTERN CHANNEL.—The winds in the Eastern Channel are generally light during the fine season, particularly in the night or morning. They set in gradually in the afternoon, and blow almost always from S.S.W. round by West to N.N.W., but they remain a very short time at any intermediate point, and soon follow the direction of the land, which, as well as we could determine, trends nearly N. by E. and S. by W. Easterly winds are limited entirely to the rainy season.

The TIDES are as regular in the Eastern as in the Jeba or Great Channel. The length of the ebb is equal to that of the flood; the former sets to the northward, the latter to the southward, but the different points of the channel, and the irregularities of the bottom, affect those directions. The mean rise of the tide is from 12 to 15 feet. The strength of the stream varies according to the breadth and depth of the channel, being greater where it is confined than in the wider parts; it is consequently more considerable in the Strait of Bulama, and the Honey Island Channel, than in any other part. Nevertheless, it seldom exceeds 2½ miles per hour, but is frequently as much as 2. At 2 miles to the westward of Pullam Island it is high water, at full and change, at 10^h 15′. The magnetic variation, in May, 1818, was found to be 17° 33′ W.

RIO NUNEZ.—The RIVER KAKOONDEE or KAKUNDY, commonly called the RIO NUNEZ, or River of NUNA TRISTAÕ, is a very considerable river, broad at its entrance, but impeded by several shoals, among which the least water in the channel is 3 fathoms. It has been celebrated as a place of trade for ivory. The situation of the entrance, as shown in the Table, is 10° 36′ N., and 14° 42′ W. It was formerly laid down much farther to the South and East.

3 B

Between the mouths of the Rio Grande and the Rio Nunez the coast is very imperfectly known, but it appears to be, in general, shoal and dangerous to a great distance from shore. On the edge of the bank, in lat. 10° 37′, and at 25 miles S.E. ¾ S. [*S.E. ¾ E.*] from Pullam Island, is a rocky bank, called the *Alcatraz*, with a rocky islet in its centre. It is surrounded with breakers, and the reefs extend from it both to the N.W. and S.W. At 6 miles to the westward is a depth of 20 fathoms.

Captain Belcher has described the Islet *Alcatraz*, the landing to which was not at all difficult, but the whole summit of the rock was covered with boobies (*pelicanus sula*). A boat's crew were employed to collect the eggs; they obtained more than 600, which proved a grateful treat, being large, and not much inferior in quality to those of the plover: but the pestiferous odour of the soil was so disgusting, and an insect which breeds on the bodies of the birds so annoying, that we cannot advise any one to land again for the same purpose.

Alcatraz is decidedly a volcanic production. Its summit is 40 feet above the sea level, but traversed almost down to the water-line by fissures, which gape from 1 to 5 feet. It is quite destitute of vegetation, and from 60 to 100 yards in length. Sharks and turtles are always near it; but the latter are not easily taken.

Alcatraz may be approached on the S.E. side; but the reefs stretch from it 5 miles S.W., *true*, and above 3 miles in width, at right angles to this bearing. Lat. 10° 38′, lon. 15° 20½′.

Nearly in the route between the Alcatraz and the Rio Nunez, in lat. 10° 30′, and lon. 15° 11′, is a much more dangerous reef, surveyed, in 1826, by Captain Owen, and by him named the *Conflict Reef*. Its western edge is 14 miles to the S.E. from the Alcatraz, and its breadth each way is from 3 to 4 miles. Two other rocky banks, to the southward of it, are comprehended within a distance of 8 miles; the South point of the latter is in 10° 20′, and has near it a depth of 11 to 16 fathoms. From this spot the mouth of the Rio Nunez bears about E.N.E. ¾ E. [*N.E. by E.*] 10 leagues.

The descendants of the Portuguese, who still exist on the banks of the Rio Nunez, are so mixed with the negroes, that they have been described as negroes themselves. The *Naloos*, in the country to the East, a very intelligent and gentle people, are farmers and graziers; they grow a quantity of rice, and their lands are fertile and populous. They are said to have made some progress in agriculture; the indigo and cotton which they raise are the finest in all this part of Africa; and they manufacture pieces of cotton cloth, which, from their texture and fine colours, are much sought after by the Foulahs of Teemboo, in the country to the eastward, who purchase them at a high price.

In the old charts of this coast no island is laid down at the mouth of the River Nunez; and we first learned, from the information of *Captain Livingston*, that a considerable sland, where Woodville formerly gave a shoal, had arisen within the last thirty or forty years. It is called *Sandy Island*, is now covered with trees, and has many palms upon it.

Sandy Island, according to *Captain Belcher*, is in lat. 10° 36′ 37″ N., lon. 14° 42′ 19″ W. Forty years ago it was a mere sand-bank, even at low water; subsequent deposition, however, has not only formed it into an island, at least 6 feet above high water, and bearing large trees, with a fair surface soil, but has also added a very extensive range of shoal on its northern, western, and south-western, sides. It is said that a passage into the river once existed on its northern side, as well as on its southern, but this seems improbable, as the bottom there is rocky as well as sandy. It is remarkable generally on this coast, that wherever rocks are thus found, sand-flats also exist, although surrounded by mud, and without any apparent source for the supply of sand. This is not strictly the case at the Nunez, there being a red sandy cliff, in course of disintegration or decay on its S.E. side; but the identity is even here not certain, both the colour and size of the grain being very different. Farther North than Sandy Island there is still a passage into the river for vessels drawing less than 12 feet; but it is narrow, tortuous, and appears to be rapidly filling up.

Captain Belcher visited the river in April, 1831, and the following passages are given from his observations.

Vessels bound to the Nunez should make the land in 10° 31′ N.; or if coming from the southward, should, at least, not advance into less than 7 fathoms till in that latitude. They will then approach the river, steering E. ½ S. [*N. 75° E.*] through regular soundings; and it is necessary to remember chiefly, that, with a flood tide, there is a dangerous

rocky flat on the starboard beam going in, while, on the other hand, a vessel may play with the edge of the breakers on the point of Sandy Island on the larboard side. The constant warning, also, "Keep in mud," which is familiar in all channels along this coast, should be here especially kept in mind.*

For a vessel to refit, no place can be better adapted than Sandy Island. It is uninhabited; and a vessel may be moored within 150 yards of low-water mark, or even less, if required, but should be prepared to haul off in case of a tornado. Small vessels may be grounded, or hauled up, for repair or examination; a space sufficient for the encampment of a crew, even of a line-of-battle ship, is free from trees; and stores may be conveniently landed. Immense quantities of drift-wood lie piled on the S.W. side; and plenty of live timber grows on the island, of which the palm yields an excellent cabbage for the use of the sick or convalescent.† Fresh water, alone, is scarce and ill tasted; and a great annoyance arises from the clouds of fine sand which are incessantly in motion over the island. The temperature, when the *Ætna* was there, did not exceed 105 in the tent; which was, however, oppressive, from the necessity of keeping it pretty well closed, to prevent the sand from imbedding the instruments. A breeze generally prevailed throughout the day, except between nine and noon. The western side is by far the most cool and pleasant, but not so convenient for communicating with the ship.

The river is very serpentine in its form, and the trees on either side impede the wind in its true course. Still, however, a pleasant, and after noon, even a fresh, breeze generally favours vessels bound up, and affords favourable slants in many of the reaches down. The general depth may be stated at 2½ to 3 fathoms at low water, with a rise and fall of about 12 feet; and although the lead generally gives mud, the anchor frequently hooks a rock, and good and long buoy ropes are especially necessary, which should be got on board the instant the tide slacks, in order to be in readiness to trip the anchor instantly, if found to be foul. The change of the tide is very rapid, and much inconvenience will be felt if completed before breaking ground.

The three principal settlements, *Walkeria*, *Cassasez*, and *Rebucko*, or *Debucko*, are all near each other, and from 70 to 80 miles up. We had formed great expectations of the supplies which could be procured at these settlements, but were much disappointed. Bullocks and sheep could be procured with some difficulty; fowls were very scarce; and vegetables could not be got at all. These native towns are never prepared to meet a sudden increase of demand for food. Of rice alone they seem generally to have a superfluity. Their trade here is the same as that along the adjoining coast, but on a somewhat larger scale; and their dealings in slaves they do not affect to conceal.

Below Walkeria not a single habitation was observed on the Nunez, though the cultivation of its banks might be profitably pursued. The want of fresh water prevents the natives settling here; but, from the nature of the soil, and elevation, there can be little doubt that it would be found on digging. The principal internal trade is maintained by the *Foulahs*, who take, in return for their goods, salt, cloth, &c. These travel in parties of twenty to forty, armed with spears, bows, and arrows; the last reported to be poisoned. They are a shrewd, intelligent people, very active, and are said to possess great bravery and perseverance, and to be inured to hard labour. It is they who bring slaves down to the coast; and it appears scarcely possible for British subjects to traffic with them, without becoming more or less implicated with this trade.

The Foulahs travel five days to their country from hence, at the rate of twenty miles a day, and rest two. They generally carry on their heads bales amounting to 60 lb. weight, the heaviest containing salt and beads. Their return is gold, in rings weighing from one to ten ounces each, ivory, slight manufactures of leather, pouches, rice, and fruit. The gold is obtained from alluvial hills; and iron is said to abound in the neighbouring country; some hot springs, but none near the settlements.

* *Captain Livingston* says:—"In making the Nunez it is advisable to make it from the *southward*; but beware of the very dangerous *Sandkinsal Rocks*, extending 6 or 7 miles to the southward of Bencer or the East Point. The reefs and banks at the entrance of the river are certainly increasing, and generally break, even in moderate weather.

"The old charts represent a river, under the name of Talagos, falling into the Nunez from the East, but I have been assured that no such river exists."

† This cabbage makes a delicious pickle, and is considered one of the finest anti-scorbutics in the world, doubly valuable when other vegetables are not to be had.—*E. B.*

The aborigines on the Nunez are called *Landamahs*, their language being, however, nearly the same with that of the *Baggas* or *Bagos*: and both call themselves *Saffres*, the name they bore in the time of Queen Elizabeth, when Hawkins first carried away some of them as slaves. One division of them, who occupy the Island of *Talabooncho*, near the mouth of the Nunez (and of which some remarkable trees are there, a principal landmark), are complete pirates, treacherous, cruel, and oppressive. They muster strong, with fire-arms, and seldom quit their island. Their town is close by the trees in question, which are seen to the northward of Sandy Island on entering; but they are found on all parts of the same island.

Above Cassasez, which is 2 miles above Walkeria, the river is much interrupted by rocks of close-grained basalt, several of them presenting a perfect columnar formation. At Rebucko, 8 miles above Cassasez, some fragments of close-grained clay slate were also observed to be used for building, and said to be procured in the neighbourhood.

Ten miles above Rebucko the river is fordable, and at 50 miles merely a stream, with repeated falls. At Rebucko the water is fresh at dead low water, and vessels have watered 1 mile above it. Alligators abound here, and some are of considerable size. It is said that they have never been known to attack any one above Walkeria; but below it the instances are numerous. Off Cassasez they were playing about the boats continually, and one came alongside, and exposing his ugly head, with distended jaws, swallowed the paunch of a sheep which had just been slaughtered.

The range of the thermometer, while the *Ætna's* boats were in the river, March and April, was at six a.m. from 75° to 84°; at noon from 84° to 94°; and at nine p.m. from 81° to 83°. The dews were slight; but at other seasons are said to be very heavy, accompanied by a fog, lasting frequently till noon.

The FOLLOWING OBSERVATIONS on the KAKUNDY or RIO NUNEZ are from a copious and valuable communication by *Captain Livingston*, who visited the river in the year 1829.

To enter the Nunez, bring *Sandy Island*, above mentioned, to bear N.E., or perhaps a little (but very little) to the northward of that bearing, and steer in right for the island, which is bold-to on the South side. The shoals generally break, and extend about 5 or 6 miles to the S.W. by W., or thereabout, from Sandy Island.

Giving Sandy Island a small berth, steer about N.E. for *Big Island*, which, in clear weather, may be seen after passing Sandy Island. Keep close to Big Island, as a rocky spit extends two-thirds, or more, over from the *Talabunch* (Talabooncho?) or western shore. It is scarcely prudent for a stranger to run much above Big Island, but rather to send a boat up the river for a pilot, and one may generally be engaged at Walkeria, or a little higher up; or one may sometimes be had from a coasting vessel.

On going up the Nunez in a boat, be cautious not to mistake any of the creeks on the western side for the main river.

In case of necessity, fresh water may always be obtained by digging a few feet deep at the root of any palm tree.

In going up the river Captain Livingston grounded about three-quarters of a mile or a mile to the northward of Sandy Island. The vessel lay for two tides on fine sand, without receiving any damage.

When at anchor, on coming down the river, in 7 fathoms, about a quarter of a mile off shore, the centre of Sandy Island bore N. by W., and the extremity of the breakers on the long spit of sand, which extends 5 or 6 miles from the West end of the island, W. by S.

The situation of *Talabunch* (Talabooncho) village may be known by some remarkable large trees, which may, in certain situations, be seen from sea, before Sandy Island can be described. I have heard it remarked, that wherever you see a large clump of majestic pullam trees (the cotton tree of the West Indies) you are sure to find a negro village; and wherever you meet with a palm tree, you may be sure of finding fresh water, by digging a few feet deep, however arid the soil may appear.

No person ought to land at Talabunch unless in company with eight or ten others, well armed, and on their guard; but on the opposite or eastern side, *Talabunchana*, the negroes, though of the same tribe, are remarkably civil and honest.

The BARRIER OF THE RIVER (as it has been translated to me from the Soozee language) is, I think, about halfway up the river between Big Island and Walkeria.

Ridges of rocks, almost like walls, and which appeared to me, when in a boat at low water, like walls of lava, extend about two-thirds across the river from the larboard or western shore; and at about a mile or a mile and a half above that, it is said that rocks, even worse, spit out from the starboard or eastern shore; but these were not seen in passing, when covered with the tide.* There are other dangers in the river, but none of magnitude until after passing Walkeria and some houses about 2 miles above it, at Cassashe. These places are both on the eastern or starboard shore. Between them and the village *Rebucko* is a very dangerous spot; but vessels drawing 10 feet may proceed to the latter near high water.†

Both banks of the Nunez are generally muddy: mangroves grow into the very water, and some of the finest tree or mangrove oysters adhere to their trunks and branches.

In the rainy season tornadoes are frequent and violent; but, with caution, vessels may have sufficient time to prepare for them. I observed none here to begin with small clouds or a small cloud, but all with heavy thunder clouds.

Vessels going to the Nunez ought to be well supplied with provisions, and not to depend on what can be obtained there, as a great scarcity frequently prevails. There are many cat-fish in the river, and above Rebucko some other kinds of fish. There are pike, similar to those of Britain, but with scales much larger.

The time of high water, on full and change days, at Walkeria is $10^h\ 17'$ a.m. Rise, from 16½ to 18 feet or more. Depth, at low water, 15 feet: bottom of fine mud. Latitude of the wharf at Walkeria, by two meridian altitudes of Jupiter, agreeing to one second, $10°\ 54'\ 22''$; lon., by 25 sights ☉ W. of ☾, $14°\ 22'\ 35''$, by 27 sights ☉ E. of ☽, $14°\ 15'\ 15''$; mean, $14°\ 18'\ 55'' + 3''$ for distance of place of observation $= 14°\ 18'\ 58''$. The tide at Walkeria runs strongly, and while I was there flowed five hours and ebbed seven; but during floods in the river (which sometimes rise considerably) it ebbs or runs down longer.

Walkeria was named from Walker, a slave factor, who realized a large fortune and died here. This place is composed of thatched huts, mostly supported on stakes, though some have mud walls, and there are two of two stories each. The population may be from 500 to 600; all Mandingo Mohammedans, excepting the slaves. *Buoy Modé*, the chief, who speaks a little English, said he had five wives, but he wanted to get some more! His arms bore many *gris-gris* or charms (they called them gregories), and even his horse's neck was loaded with no small number of them.‡

* This barrier or rocky dyke is described by Captain Belcher as about halfway up to Walkeria. "It presents the appearance of a basaltic formation, disturbed by igneous action, the sides having a scoriaceous look, and has lifted itself through what is apparently a perfect flat of columnar basalt, but which, under the hammer, proves to be red sand-stone. The dyke itself is a mixture of ferruginous sand, with coarse quartz grains and balls of jaspery nature, forming a coarse conglomerate, exhibiting, both internally and externally, marks of fusion. It is in two pieces, with a gap about 25 feet between; is nearly 50 yards long by 2 wide, and rises perpendicularly through the disturbed stratum about 8 feet; direction, East and West.

"The disturbed stratum is a fine sand-stone, with columns as perfectly prismatic as any basalt ever seen. A little to the northward is another similar formation, but comparatively undisturbed, having only a slightly arched back, presenting the appearance of a carefully paved landing-place. The columns are not above 8 or 9 inches in diameter; and some pieces brought away were only 3 to 4 inches, by 5 or 6 long."

† The rafters of the roofs of the huts and houses on the banks of the Nunez are of bamboo; but the bamboos are not nearly so large as those of Jamaica.

‡ King Macandeh and his subjects at Rebucko or Debucko are Kafirs or Pagans. Macandeh is king "*de facto*," but it is said *not* "*de jure*." He is or has been an extensive slave-trader. His palace is of mud or earth, baked up into round lumps, then laid one above another, and the interstices filled up with wet earth or mud, well mixed, until the whole wall appears one mass. The palace is two stories high, very prettily situated on a considerable eminence, and commands a fine prospect.

Circumcision is, so far as I could learn, general among both Mohammedans and Kafirs, and usually is performed at the age of 12 or 13. When circumcised, the children are put into a part of the wood called the *Seymoe* or *Devil's Bush*, from which they are not permitted to emerge until cured; but there are attendants to provide food for them. There are two seymoe places near Walkeria; one about 150 yards S.S.W. from it, among very large trees, and the other about 300 or 400 yards N.N.E. from it, among much smaller trees. In the latter I understood the children were put, while the former was sacred to the meetings of a secret

There is a great deal of trade carried on in this river, both legal and illegal. There are four British traders established here, and three or four French likewise. A good deal of coffee is brought down the river from the Foulah country. In 1838-39, about 100 tons of Nunez coffee were shipped to England, in the expectation of succeeding in getting the Commissioners of Customs to consent to its introduction at a low duty. In that expectation the merchants were deceived, and a stop is put to any further importations of Nunez coffee.

RIVER COMPOONEE.—CAPTAIN BELCHER, in the prosecution of his survey, made out three mouths to the Rio Nunez, and 10 miles N.W. of the northernmost, much to westward of where land was expected, saw a cluster of islands, which gradually showed their close approximation to the main, and were ascertained to form the North and West boundaries of the entrance to a river or inlet, larger at its mouth than

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society which the Kafirs have among them. It is death by the law for an uninitiated negro to enter the seymoe bush; I have been told they would overlook a white person's doing so, but I did not make the experiment. They are also said, "from being so unfrequently trod," to abound with snakes and wild animals.

At the N.N.E. seymoe bush a good many loose stones lay along the river's side, but I could not get one of them for ballast, as the negroes believe that whoever takes any of them will soon die.

There is very little cultivation on the Nunez, excepting some rice, which, unlike that of Carolina and Spain, grows to the very hill tops, and requires no artificial irrigation, and some patches of the *yuca*, or sweet cassada plant. There are but few fruits; the principal are papaws, cashews, wild figs, which, though in shape and flavour resembling cultivated figs in some degree, grow on a tree entirely different in form and leaves from the genuine fig. Two kinds of plums; one dry and mealy, with a russet skin (like a French russet apple), very astringent but not disagreeable taste; another yellow, and of an agreeable sub-acid flavour.

The palm trees on the Nunez, with their rough scaly coats, are neither so tall nor so handsome as the smooth barked palm trees of Cuba, neither is the cabbage at the top of the same shape or appearance.

The *locust tree*, as soon as the rainy season begins, ripens its fruit, which hang in clusters from the branches like clusters of small beans, and furnish a great part of the negro's food at that season (say about May). The pods contain small beans, like our horse-beans, or the Spanish algarrobas (carobes): but the most nutritive part consists in a yellow-coloured farinaceous substance, lying in the husks or pods in the interstices among the beans, and indeed imbedding the beans, which resembles flour mixed with honey or sugar, and probably may be the kind of fruit on which John the Baptist fed in the wilderness. The ears of corn plucked by our Saviour and his disciples must have been ears of maize, or Indian corn.

The swarms of wild bees are tormentingly numerous, and when they get irritated, as for instance when any one throws the rind of a lime into the hive, the essential oil of which sets them absolutely mad, every one near them must fly, and either escape into a dark place or into a place where there is much smoke.

Considering the immense forest, there are very few birds, but immense numbers of baboons and monkeys, of different species, which make a terrible yelling among the woods on the banks of the river at night. Leopards are pretty numerous (though I saw none alive), and there are some tiger and musk cats. There are also, I was told, some deer, but the only kind I saw was a small bluish-gray coloured one, which is tolerably good eating. Some call them the forest goat (hilotumbo is the native name), but they are much more like a deer than a goat. There are some elephants near the Nunez. I saw none. Lead balls will scarcely penetrate their hides, therefore the negroes used to shoot them with iron balls; but I am told they now use a sharp iron, shaped like a chisel, with a rod to it, which goes down the musket-barrel to the charge, like a rocket-stick to a rocket. I saw a hippopotamus several times opposite Cassache (Cassasez?). The head seemed large, out of all proportion to the body, and the legs very short. Although amphibious, they always feed ashore, and are said at times to do great damage to the rice-fields. There are some alligators in the Nunez; I saw one which I am inclined to think was from 17 to 20 feet long.

Among the remarkable animals of the country is a species of ape, without any tail, of which the most marvellous stories are told; but even the well-authenticated ones are sufficiently wonderful. They are described as walking erect, are 4 to 5 feet high, and possessed of wonderful strength and agility. It is said that troops of them sometimes come down on the negro villages, where the inhabitants, not daring to face them, retire to and barricade their houses; and the *Demos* (as they call them) rob their yuca fields, making the roots up in regular bundles, and carrying them away on their heads; as they are also said to do with bundles of locusts or carobes. The leopards also sometimes enter the very villages, and produce great ravages.—*A. L.*

the Nunez; and, at 12 miles within the distance to which he surveyed it, deeper, swifter, and promising as large or larger branches. Where Captain Belcher stopped, it came from the East, and showed several extensive arms leading to the North and West. The entrance by which he ascended has two large channels, equally navigable, but its mouth is so studded with shoals, that until better known, few vessels will probably venture into it; the natives North of the Nunez having also the general reputation of being dangerous. The western entrance is equally fair and navigable to the sea. The northern alone is very shoal, and probably passable for canoes only: several of these were seen at a distance, and one country schooner; from which, and the numerous fires at night, it seems likely that the banks are well inhabited, and have some traffic.

Upon a renewal of the survey in 1832, it was found that small vessels only could navigate this river without great risk, there being a chain of reefs, which nearly bars the passage; but, above this barrier, the channel is sufficiently deep for larger vessels, and has few dangers. The scenery, on ascending, becomes very picturesque; and, in some spots, was even splendid for this coast, where all may be so easily described as mud and mangrove. The land being *terra firma* in the literal sense, the shrubs were in great variety, and the banks were, in many places, completely guarded by close-set clusters of the pandanus, or screw-pine, a tree not usually considered a native of Africa. On the passage up, several groups of natives were seen, apparently very timid, and in a state of nature. Judging from the fires in every direction, they seemed to be numerous, and the perpetual sound of tom-toms, a kind of drum, was heard during the night.

At about 20 miles up, and at low water, the stream was found to be brackish, but quite fresh enough for cooking. Ten miles farther it was quite fresh at low, and at 40 miles nearly so at high, water. Alligators and hippopotami were plentiful, with occasional groups of monkeys. Few birds were seen, and those merely great fish eagles, herons, spoonbills, and kingfishers, with occasionally doves and guinea fowls, heard and seen inland, but beyond reach. On a second night's bivouac the water of the river was found perfectly clear, and the banks of the river also began to show stony landing-places, with grassy points, and but little mud. The course of the river was generally to the northward, and frequently N.W. to W.S.W.*

During the severe service of the *Ætna* on this coast the crew suffered much, and scurvy appeared to enter deeply into their constitutions. Fish diet was found to aggravate this, and the only thing which appeared materially to check the disease was beer made of the essence of malt and hops. A general use of this on the coast of Africa would be very salutary, and have the effect especially of keeping up the constitution of men subject to heavy labour in boats. The fresh meat diet, afterwards obtained in the Gambia, was of much less obvious benefit than was expected.

THE COAST FROM THE RIO NUNEZ TO THE ISLES DE LOS, &c.—From the Rio Nunez to Sierra Leone, in an extent of about 55 leagues, the coast is in general low, in most parts swampy, and intersected with creeks, which, connecting the adjoining rivers, form an excellent navigation: but at unequal distances, from 5 to 20 miles, in a right line from the sea, the land rises gradually; and beyond that distance, in many places, towers into lofty mountains, which, after a tornado, when the air is pure, may be seen 10 or 12 leagues off.

A small isle, called *Young Gonzalez*, lies about 5 miles to the eastward from the regular entrance of the Rio Nunez. It is the southernmost of three, having channels communicating with the Nunez; about 5 miles true East from it is the mouth of the *River Cappatches*. From Young Gonzalez a long and dangerous flat of rocky ledges, gravel and sand, extends S.W. (by compass) nearly 6 miles. At low water, a patch, three-quarters of a mile in length, has over it only 6 feet of water. Its composition is a coarse red sand-stone, or conglomerate, like lava, till broken. The *Coppatches* is a trading river, but shallow, and frequented only by boats, or vessels not drawing more than 4 feet of water.

CAPE VERGA, in lat. 10° 19′, is the termination of some moderately elevated land, and not a mangrove island, as commonly described. A long and dangerous spit

* On prosecuting the examination it was found that this river is named the *Compoonee*. Captain Belcher has given a pleasing description of its course upward; for which see the Geographical Journal, vol. ii. pp. 287-8. In the upper part many indications of buffaloes, hippopotami, deer, lions, panthers, monkeys, &c., were seen.

extends from it N.W. 6½ miles. In the deep bay within this no vessels can enter which draw more than 4 or 5 feet of water. This place is S. 21° E., *true*, from the mouth of the River Cappatches.

The coast hence southward appears to be a great series of islands, some forming, others breaking up, so that in twenty years the aspect probably will be materially changed. The high mountains of Cape Verga, which stand about 3 leagues inland, to the north-eastward of the cape, serve as a mark for it, and may be seen at the distance of 15 leagues. Thus, bearing East [*E.N.E.* ½ *E.*], are they equally useful to ships bound to the Rio Nunez, which, with this bearing, will clear the banks lying without the river at 5 or more leagues to the south-westward.

Of the mountains within Cape Verga, two, in particular, are the most conspicuous, and the highest, according to M. Roussin, is in lat. 10° 18′ 52″, lon. 14° 21′ 20″. These mountains have no particular peak, but form nearly one mass, extending from N.E. to S.W., and are about 500 fathoms in height.

RIO PONGO.—The entrance of the Rio Pongo is about 24 miles S.S.E. ½ E. [*S.E.*] from Cape Verga. The river is well known as a place of trade on this part of the coast, and its consequence has been increased by settlements of slave-traders on its several branches. To the country are several entrances, or inlets, but all seem to be included under one general name, *Pongo* or *Pongas;* each is impeded by a bar of mud or sand; and the coasts, to the head of the several rivers, are entirely covered with mangroves.

Captain Belcher says:—It is difficult to imagine how the natives exist on the exterior islands between the Nunez [Kakundy] and the Pongas. They are in general populous, and yet do not, for the most part, contain fresh water. The consumption of palm wine on them is great, but this cannot altogether support the inhabitants as drink. The palm wine is the fermented juice of the head of the palm tree; and is obtained by driving a hard peg, or boring with a gimblet, into this head or cabbage. A stream of liquor flows into a calabash suspended beneath it; and by the time it is filled (about six to eight hours) fermentation has reduced the whole into a milky tinted pleasant beverage; but the natives generally allow this to proceed too far, when the wine acquires a bitter flavour.

The various uses to which the palm is applied are remarkable. It is truly the natives' friend: it supplies wine, oil, fishing lines, hats, baskets, palm-nuts, and, by taking off the head, a most excellent repast in the cabbage, which will feed a family of ten or twelve persons. Between the young branches, also, covering the cabbage, a fine cotton looking down is found, which, when scraped off, dries almost instantly, and forms an excellent tinder, resisting wet, and used accordingly to convey fire along the surface of the water from boat to boat when fishing. It is lit, and being thrown overboard, is picked up as it drives along: and there are other uses to which different parts of the palm are applicable.]

The first of the *Pongas*, or entrances to the *Rio Pongo*, is about 10 miles to the south-eastward from Cape Verga. This is called the *Cossencey Bar*, having a shallow and dangerous entrance, though within are 4 and 5 fathoms of water.

The best channel in, for a stranger, is over that called Rissing Bar, or the MUD BAR, which lies in lat. 10° 2′, and extends more than 2 miles out from the river to the westward. On the North side of it are only 6 feet, on the South side from 6 to 9 feet, and on the middle, 12 feet, at low water. From this bar, two hills up the country, called the *Paps*, bear E.N.E., and serve as the mark for the river. A grove of palm trees, on the North side, is also a distinguishing mark.

To sail over the Mud Bar, get the river open, and steer in N.E. by E., keeping the Paps, which are moderately high, a cable's length open of the North point, by which you will carry 4 fathoms in depth at high water, or 2 fathoms at low water. Anchor in 7 or 8 fathoms, in the middle of the river, abreast the palm trees on the larboard hand, which trees appear to extend about 2 miles in length. Then send your boat up the river for a pilot, or fire a gun twice or thrice, at intervals of about an hour, and in all probability a pilot will come off to you.

If bound to this place in the night, approach no nearer than to the depth of 4 fathoms until daylight. If beating in, stand no farther to the northward than to bring the two hills in the middle between the two points of the river; then stand to the southward to 2 and 2½ fathoms, and proceed as shown hereafter.

If going in, with a fair wind, bring the North point of the river, with its palm trees, to bear N.E., and run in with it bearing N.E. by E. On entering, keep on the South side, within the bar, as the flood tide sets on the northern breakers. Should you here have a quarter-less-two, you need not fear, as the bottom is all of mud. The river hence lies East and West, about 8 miles, and its depths, in mid-channel, are 3, 4, 7, 6, and 5, fathoms.

The Sand Bar is 5 miles to the southward of the Mud Bar, and its entrance is more intricate; therefore not to be attempted without a good pilot. This is, nevertheless, the *Mouth of the Rio Pongo*, properly so called. In the best channel, at the entrance, the depth is 12 feet at low water, and within it are 4 and 5 fathoms.

A small sand-bank having showed just above water, at high tide, to the northward of the Sand Bar, and mangroves having taken root on it, the bank consequently increased, and the natives have planted palm trees on it. There is said to be a passage of 3 fathoms to the northward of this islet.

Vessels bound to the Pongas sometimes make the high land of Cape Verga, and sometimes go to the Isles de Los for a pilot, although one is not always to be found there. Some run in by their latitude, taking care to sound frequently, as soundings extend out 1½° to the westward.

The time of high water here, on the full and change, is 9^h. The rise, about 10 feet.

Sand Bar *of the* Rio Pongo, *N.N.E. ½ E.*—*A*—*Barkia Hill; remarkable table-land.*

Captain Belcher has noticed, that the resources offered by the Pongas are few, without proceeding up to a great distance; and even then appear but trifling, and cannot be obtained by money. The trade is confined to rice, skins, bees' wax, cola nut (African coffee), gold dust, a small quantity of ivory, and slaves. Stock is scarce, the water bad; and arms, ammunition, tobacco, and handkerchiefs, are the only equivalents courted. The seine was hauled twice off the entrances with good success; and some varieties of fish were procured, not previously known. One was a species between the shark and raia, having the teeth of the latter, but otherwise resembling the former. It is one of the finest fish on the coast; the fin parts like those of the skate, making most excellent soup; and another advantage is, that it does not decompose so soon as other fish. The cat-fish (*silurus*) was also taken; for, though usually treated with disdain, this is both a well-tasted and peculiarly wholesome fish; in proof of which may be added, that the natives give it a decided preference, and are rather cautious of others.

In May, 1842, Captain Nourse, of H.M.S. *Iris*, destroyed a slave-trade factory in the Rio Pongas, the business of which was carried on by Mrs. Lightburn, but the slaves were removed during the preparations for the attack, with the exception of eleven, which were liberated. In destroying the factory several barrels of powder exploded, wounding several, and killing one man belonging to the *Iris*.

From the Mud Bar of Rio Pongo to Dembia River, a place of some trade, and more to the south-eastward, the distance is 8 leagues. Two leagues to the southward of the latter is *Sangaree River*, whence the land juts out to the *S.S.W.*, *true*, 6 or 7 miles to *Tumba Point;* beyond which, to the eastward, is the high volcanic land named *Mount Suzos;* and westward, are the *Ilhas dos Idolos*, or *Isles de Los*, at 2½ miles from the point.

Mount Suzos, properly so named, but which, in the charts, appears under the name of *Sangaree*, has a regular conical peak, excepting that, on its southern side, at halfway up, there is a large protuberance. This insulated mountain, in lat. 9° 34′, is a certain mark for the Isles de Los during the rainy season. In the dry season the atmosphere is always so hazy, that the coast of the continent is seldom seen, even near these islands.

At about 4 leagues to the northward of Mount Suzos is another mountain, called the *French Mountain*, to which M. Roussin assigns the latitude of 9° 45′ 50″, and lon. 13° 26′ 10″.

On the 24th of May, 1826, Captain Owen, when in lat. 10° 2′ N., saw the Sangaree mountains; one formed a sugar-loaf, between 4,000 and 5,000 feet in height. Having

been twelve days in this neighbourhood, on a previous occasion, it may seem strange that it was not then observed; but it was during the dry season, when there is always such a haze over the land, particularly in the day, that the view is always much limited; but in the rainy season every shower clears the atmosphere, and the most distant objects may be discerned.

WINDS, &c.—In March, 1831, H.M.S. *Ætna*, after passing Cape Verga, lost the land-breeze, which had previously blown with extreme regularity from about ten p.m. till morning, and been calculated on, with certainty, in moving the ship along-shore. The winds also became much affected by changes in the tides and time of the moon; as, for example, if it were low water at noon, there was seldom wind enough to move the ship till the first quarter flood, and then the tide was too strong to weigh. The weather also became more hazy, so as to prevent the use of the sea horizon; and for the three days preceding full and change, this was so much the case, as inconveniently to shorten the bases of triangulation.

ILHAS DOS IDOLOS, or ISLES DE LOS.—These isles, which have already been mentioned, lie between the parallels of 9° 25′ and 9° 32′ N., and between meridians 13° 46′ and 13° 52′ W. They are six in number, but only three are inhabited, the rest being little better than rocks. Those which are inhabited are extremely pleasant, and, in general, healthy. The easternmost island, on which the English factory was established, lies nearly North and South, with a high wood-crowned hill at each end, which, when seen from sea, appears like two islands. It is 4½ miles in length. The road is on the eastern side; and, during the dry season, is very safe: but, in the tornado and rainy season, there is no security, unless in the goodness of anchors and cables.

Tamara, or *Footabar*, the largest and westernmost of these islands, is nearly semicircular, rising on both sides from the sea by a gentle ascent, to a moderate height, and is covered with good timber trees. It is 5 miles in length, and the summit of its northern part is 465 feet above the sea. That of Factory Island is 470 feet.

M. Golberry says:—"The three principal isles of the group unite to the advantage of a situation very favourable for commerce, those of a fertile soil and healthy climate. They are exempt from those local diseases produced by stagnant and corrupt water, because they abound in pure and fresh springs: as the soil also rises in hummocks, above the sea, they enjoy those refreshing breezes that allay the heat of the suffocating climate at the rising and setting of the sun.

"The English establishments," he adds, "are conducted with the greatest address. The residences of the commercial agents, &c., are commodious and wholesome; and the magazines, docks, and warehouses, have all requisite solidity."

In a description of the Idolos, or Delos Isles, by the *Baron Roussin*, the admiral says, the isles worthy of description are, Tamara, the Isle Idolos, or Factory Island, and Crawford Island, by the French called Isle Françoise. Tumba, on the East, is so connected to the continent by beds of sand, mostly dry, that it can hardly be considered as an island.

TAMARA, the largest and westernmost island, may be seen in fair weather at the distance of 7 or 8 leagues. On approaching, it appears like a range of hills, thickly wooded; its elevation is moderate, and the northern part higher than the South. It is, in shape, like a crescent, with its concavity to the S.E., forming several fine anchorages and depths of 6 to 3 fathoms, at low water.

You may enter the roadsteads on the eastern side of Tamara either from the northward or southward, only giving the coasts a berth of three-quarters of a mile, beyond which distance both the North and South points are quite clear. A reef, the *Arethusa*, surrounds the North point to the distance of a quarter of a mile. The western side is bold-to, and may be approached safely. *Variation*, 18° W.*

Near the principal anchorage within Tamara is a spring of fresh water, where eighty hogsheads may be obtained in twenty-four hours.

At the distance of 1¼ miles S.S.E. from the South end of Tamara is an inlet named *Coral Isle*, leaving a passage between of 9 and 8 fathoms; but, in the same direction, at a quarter of a mile from Coral Isle, is a small but dangerous reef, which must be cautiously avoided.

* Survey by Lieutenant James Badgley, of H.M. ship *Leven*, 1827.

The central island of the group is *Rooma*, or Crawford Island, the western summit of which is 300 feet in height. From this island to the N.E. are shoal flats, extending to the distance of 2 miles, toward the North end of Factory Island, leaving a channel between of only two-thirds of a mile.

"The English establishment occupies Crawford, as well as Idolos, or Factory Island. The resources for shipping at the isles are abundant and important. Exclusive of wood and water, which may be readily obtained, supplies may be had of cattle, goats, rice, poultry, pumpkins, bananas, oranges, lemons, and citrons. The cattle are small; but the flesh is well flavoured. These articles would be dear enough if paid for in money, but come cheap in exchange for articles of merchandise. The following are sure to be called for: clothes, linen cloth, hardware, gunpowder, iron, firearms, brandy, and tobacco."*

Captain Belcher (1831) describes the islands thus:—The Isles de Los consist of three principal islands, Factory, Crawford, and Tamara or Footabar, besides several small islets and reefs, enclosing a convenient and safe anchorage for shipping. On Factory Island is a small factory, which keeps up a communication with the main; the natives thus procuring English goods for rice, wax, hides, a little ivory, bullocks, goats, fowls, yams, pumpkins, cassava, bananas, limes, cola [the coffee of Soudan†], pistachio-nuts; and, in the rainy season, oranges, with a few other fruits. Factory Island is well cleared of its woods, but the others only partially so. Good water is to be had on Tamara, and all the islands are said to be healthy, but with something, perhaps, in the atmosphere, or mode of living, which favours the formation of cataracts in the eye, many of the natives being affected with them. Vessels with much sickness on board might certainly resort hither with advantage. The thermometer at noon stands generally at about 82°.

This establishment, formed by Sir Charles Macarthy, was finally abandoned from the bad water and climate; the mortality among the troops, and other residents, was not exceeded on any other portion of the coast.

The Isles de Los are of volcanic origin, being formed chiefly of hard blue and iron-coloured lava, with occasional masses of porphyritic hornstone of different elevations. Of the vegetable productions, the most remarkable are the palms, which furnish palm oil and wine, and the silk cotton tree. The natives also speak of a tree, the bark of which is an excellent bitter; but it was not seen.

The natives belong to the tribe named Baccas or Barkas [qu. Bagos?], who also occupy other islands along the coast. A great similarity exists between their language and that of the tribes inhabiting the banks of the Nunez.

The rainy season here commences in April, and ends in December.

The seasons have here been described as follow:—To begin with January. About the 8th or 10th of this month the *Harmattan*, or cold strong easterly winds, continue, with some strength, for about a week or ten days; after which, the land-wind and sea-breeze take place till about the middle of February, when the wind becomes continual and N.W. or N.N.W., till the last full change of the moon in March. The tornadoes generally begin and prevail, more or less, till May or June: then the rains set in, and are almost continual all July and August: they begin to abate in September, and go off in October, giving place to the tornadoes, which continue till about Christmas. During the rainy seasons the winds are mostly between South and West, or in the S.W. quarter; and the tornadoes always blow with prodigious force from the E.S.E., or thereabout, accompanied with thunder, lightning, and a deluge of rain. When a tornado has happened in the night,

* "17th January, 1826, at the *Isles de Los*. These islands had recently been purchased by our government, and costly barracks (now almost in ruins) had been built on Crawford Island, where there is no water. The soldiers were drawn from the African corps, which is composed of convicts from our regiments of the line," &c.—*Captain W. F. Owen.*

In 1829 the troops had been withdrawn. Tolerable water might have been obtained from a deep well, but that is much better on Tamara. The settlement, as hereafter mentioned, is now abandoned altogether.

† The Mandingo name for this is *Gourou*, which they pronounce *Wurru*. It is astringent and bitter, and seems to contain *tannin*. The natives use an infusion of it, which resembles coffee; and as, when eaten raw, it removes hunger, it is carried in expeditions for this purpose. As an article of traffic it is said in some parts of the interior to be worth its weight in gold, being used by the natives whenever they can procure it.

it is impossible to imagine the clear state of the atmosphere next morning; we have nothing like it in Europe.

Captain Belcher says, that the rainy season between the Gambia and the Isles de Los ranges, in its commencement, between the 1st of April and the 1st of June; and terminates from the 1st to 31st of December. Off the Conflict reef and Bijoogas, rains and tornadoes were experienced on the 12th, 14th, and 15th May, 1831.

The flood, at the Isles de Los, sets to the North. The tide rises and flows as shown in the Table, page 174.

COAST between the ISLES DE LOS and the PONGO.—(*Captain Belcher.*)—Tumbo Point is about 2 miles distant from Factory Island: and is a long rocky flat, partly covered at high water, and divided from the main by a narrow channel, navigable for canoes at high water, but nearly dry at low, where the natives affirm that they can walk across, though the depth of mud makes this improbable. From this the main land rises gradually, and partakes much of the features of the Isles de Los, without, however, being quite so denuded or bare as the summit of Tamara. The whole interior is mountainous; the highest peak of which we could obtain a measurement being 2,910 feet above the sea. This mountain is called *Kakulimah.* Farther on, the *Sangaree* or *Soomba Ridge* commences, and forms the entrance of the *Sangaree* or *Debrika River.* The highest point of which, Tikitee-chin, or, as pronounced, *Tikit-chin*, is 1,705 feet above the sea. Its western point is called *Alligator's Point*, and off this the mud extends above a mile, dry at low water.

The whole of this bay is one series of flats and reefs; and no vessel drawing above 6 feet should venture within a line drawn from Tumbo to Alligator Point. Vessels drawing 15 feet should not, when working up along this shore, do more than open Crawford Island; and, to ensure good room, should even tack when the East end of Tamara opens the South end of Factory Island. Within these bearings the soundings are very regular, and nowhere less than 5 fathoms.

The entrance of the Sangaree River has 2 fathoms in it; but there is little inducement to ascend it, there not being the slightest trace of trade along its shores, nor any supplies to be procured from them, excepting wood. The water is scarce and bad. The *Ætna's* boat ascended 15 miles.

More to the North there is a small isle in the centre of a river called the Dembia, but which is, in fact, a mouth of the Sangaree. From this isle, Alligator Point bears S.E., *true*, 5¼ miles. The river will admit very small vessels; but the greatest depth is only 1 fathom at low water, where the sea curled.

The shores hence are thickly clothed with mangroves, and extend about 16 miles to the first acknowledged mouth of the Pongo, called *Tàboury* or *Old Pongo*, which is bordered to a mile out by dangerous breakers.

DIRECTIONS FOR SAILING FROM CAPE ROXO TO THE ISLES DE LOS.

By the Baron Roussin.

The description of the Bissagos, already given (page 362), points out the course to be steered in order to double their S.W. extremity. A vessel starting from a point at 4¼ leagues to the westward of Cape Roxo, which will be a little without the medium of 17° 0′ 0″ W., to the parallel of 10° 40′ N., will be outside of all the dangers. From hence a course of S.E. ¼ E. [*S. 68° E.*] and distance 68 leagues, will lead her to the West point of Tamara Island. On this course the soundings will never be under 8 fathoms, until near the shore of the island; and those on the first course will be considerably more.

From the parallel of Cape Roxo to that of the western breaker, 11° 31′ 32″ N., at a distance of more than 4 leagues to the westward of the meridian of 17° 0′, the depth will increase progressively from 8 to 28 fathoms, and the bottom be entirely of mud. This remark may be depended on to show that a vessel is not far to the southward of the parallel of the Jeba or Great Channel; she cannot at the utmost be more than 10 miles from the positions already given. From this point, as far as the parallel of 10° 40′ N., the bottom is nearly free from mud, and on passing to the southward of the parallel of 11° 20′, very slight traces of it remain, but are succeeded by a bottom of fine white sand, sand and gravel, sand and broken shells, with a depth varying from 12 to 50 fathoms. A vessel, having left Cape Roxo, and arrived in lat. 10° 40′, may thence steer a direct course for the Isles de Los.

The S.W. edge of the Bissagos follows a gentle curve from the western breaker as far as the southern one, that of La Bayadère. The bottom, in this part, presents a singular peculiarity. Amongst the fine white sand, sand and broken shells, sand and gravel, of which it is most frequently composed, a greenish-coloured sand is sometimes found. The depth decreases very gradually from 50 to 9 fathoms, from S.W. to N.E.

The remainder of the course to the Isles de Los passes over deep soundings, as much as 50 fathoms, at the point of departure, and the least depth is 12 fathoms. No precise rule can be given as to the changes in the depth along this track, nor as to the various nature of the bottom. It is known only that the ground, in the space passed over by this course, seems to be furrowed with channels, which, commencing from the southern extremity of the Eastern Channel of Bissagos, diverge toward different points between *S.W.* and *S.S.E.*, *true*. The furrows above mentioned appear to have been caused by the regular tides in the mouth of the Rio Grande, and prove, beyond a doubt, that the outlet of the same channel is partly caused by that river. With respect to the nature of the bottom, M. Roussin says that he remarked the total absence of mud. The bottom is of fine sand, in some places mixed with broken shells, small pieces of brittle rock, and gravel, which appeared to be only a covering to beds of a whitish volcanic sandstone, into which the lance penetrated but 3 or 4 inches, and did not hold. A muddy bottom is not found until about 10 leagues to the westward of the Isles de Los, and then only in small quantity, till within a very short distance to the N.W. of those islands.

Tides.—In proportion to the distance from the mouth of the Jeba or Great Channel of Bissagos, either to the northward or southward, the tides lose their regularity. This interruption in the tides is evident in going to the southward, as, at a few miles South of the parallel of the western breaker, 11° 31′ 32″ N., they are no longer perceptible, even on the edge of the Bissagos.

No decided course of the current was ascertained to exist, but it is generally allowed that the waters have a greater inclination to flow to the southward than to the northward; and it may be presumed that it follows the direction of the winds on the western edge of the Archipelago, but it is seldom found to be considerable.

ISLES DE LOS TO SIERRA LEONE.*—Description and Directions by Captain Boteler, of H.M.S. Hecla, 1829.

The portion of coast between the Isles de Los and Sierra Leone comprises an extent of 66 miles, and contains several rivers, islands, and banks, besides various inconsiderable creeks.

Between the Isles de Los *and the sharp low point of Tumbo* there is a safe channel, through which, by Captain Owen's charts, ships may carry 3 fathoms of water, and which may be, at times, highly convenient to use, or even to run through the group; yet, without some good reason for so doing, it will always be advisable to go outside the islands, where certainly no dangers are to be met with.

In approaching this part of the coast it may be remarked, that though the 3 fathoms' boundary, in some places, extends to a considerable distance, yet the soundings are so regular as to give ample warning. A tumbling sea, at times, may prevail in a strong breeze, yet, as no gales but the Tornadoes, which are of short duration and off shore, are known upon this coast, a commander need never be alarmed; for there is always good anchorage under foot, and no long swell current to force the vessel into danger.

From Tumbo Point to Matacong Island the bearing and distance are S.E. by S. 23 miles. Tumbo Point is the S.W. extremity of an island bearing the same name, and separated by a very narrow high water channel from the main land. To the southward of this point the land falls back to the north-eastward about 7 miles, forming an extensive but shallow bay, at the bottom of which is an inconsiderable stream, called *Tănnāney River*, accessible to canoes only.†

* See Chart of this coast from the Isles de Los to Sherboro Island, published at the Hydrographic Office, and corrected to 1830.

† See Chart, with the entrances of Tănnāney, Mahneah, and Morebiah Rivers, by Captain Boteler, published at the Hydrographic Office, 1830.

In the extensive bay between the Isles de Los and Matacong Isle no detached dangers exist. The coast is safe to approach, the soundings being gradual, and always affording good anchorage; and it is, in all parts, accessible to large ships to the distance of 6 miles, which generally may be considered sufficiently near to distinguish the land, and often to recognise the mouths of the rivers.

Mahneah River, about 12 miles E.S.E. from Tumbo Point, is, at low water, scarcely accessible to the smallest coasting vessels, but the rise of tide exceeds 2 fathoms. The entrance is about 6 miles south-eastward from that of Tănnāney, but the water between is very shallow; and a mud bank, which extends south-westward from the West point of the entrance, is uncovered at low water, more than 2 miles from that point. A similar mud bank lines the East side also, leaving the channel between above a mile wide, but carrying only from 4 to 8 feet at low water.

To enter this river it is necessary only to bring the western point of the entrance, while at the distance of 5 miles from it, to bear N.E. by E. ¼ E., and then steer toward it in that direction, until you get close to the S.W. mud bank, when you may proceed along by the edge of that bank, in a convenient depth, according to circumstances. Within the river the depths at low water are from 6 to 10 feet only.

The water discharged from this river must be very great, as the ebb tide runs out with great rapidity.

River Morebiah.—The mouth of this river is about 18 miles S.E. by E. ½ E. from the Isles de Los, and about 7 miles northerly from Matacong Island; and, though its breadth within the points nowhere exceeds half a mile, yet it is far superior to the Mahneah, last described. Its entrance is narrow, and forms an elbow at the commencement, which, to render perfectly safe, would require *two buoys*, because the coast is destitute of good objects to serve as marks.

In approaching the coast abreast of the river, with its opening bearing E.N.E. ½ E., distant about 9 miles, and Matacong Island S.E. by E. ¼ E., you will have 6 fathoms of water on black mud; from this situation the depth will decrease gradually, on a bottom of the same kind, to 3½ fathoms at the entrance of the channel. With the rounding of the land between the rivers Mahneah and Morebiah bearing N.N.E., the East point of the entrance E. ¾ N., and the middle of Matacong Island S.S.E. ¼ E., you will have that depth, and be at the spot marked with an *anchor* on the plan. From this position steer N.N.E. until the East point of the river bears E. ¼ S., and then stand in toward this point, or about East; but remembering, that both flood and ebb set partially over the extensive shoals that form the S.E. side of the channel: some of these, however, being dry at low water, and nearly so at high water, their steep boundary is perfectly discernible. In the elbow of the channel the least depth is 1¼ fathoms at low spring ebbs: this depth, however, continues but a short way; and, from the time of altering your course to the eastward, or steering straight in, you will seldom have so little as 2 fathoms. Beyond the East point the depth varies from 4 to 6 or 7 fathoms, and for the extent of 7 miles up the river it appeared to be clear of all danger.

About 4 miles above the East point of this river, and on the same side, a remarkable round mass of granite rock rises abruptly, about 40 feet from the water's edge; it is about 400 yards in circumference: others may be seen inland; and the natives assert, that several are scattered about as far as the *Sangaree Mountains*, which, they say, are also of granite.

It is high water, on full and change days, at 7^h 40′, and spring tides rise 11 feet.

The contrast which this coast presents to the eye, in different states of the atmosphere, has been already noticed in pages 124, 125, and 378.

Matacong Island.—The beauty of this island consists of the luxuriance of the trees, the verdure of those spots which have been cleared away, and the gentle rise, which renders it a conspicuous contrast to the low swampy tract opposite. It is more than a mile long, and having been purchased from the natives by Mr. Gabadon, a merchant of Sierra Leone, is now established for rearing cattle. The island appears to be of lava, yet on its summit there are two large pieces of granite; but there is reason to believe that they have been artificially placed there.

Matacong is surrounded by mud banks and rocks in all directions, so that no vessel of any burden can lie at anchor within 2 miles of it. The channel, which divides it from

the main, is nearly three-quarters of a mile broad, but its muddy bottom, at low water, is left dry.

From MATACONG ISLAND to SALLAHTOOK POINT, a distance of 14½ miles S. ¾ E.,* the general features of the coast are the same as those already described, but the mountains are too distant to be distinctly seen; here and there a *cotton tree*, with smooth trunk and spreading foliage, rises above the surrounding thickets, and serves to identify the locality of the coast to those who are acquainted with it; but a stranger can make the mouth of the river which he intends to enter by his latitude only, or by running the coast down from some known point.†

From Matacong Island the coast trends to the eastward a little more than 3 miles, where it turns abruptly to the northward, and forms the West point of the mouth of the RIVER FORECARREAH; the interval being fronted with sand and mud banks, which extend more than 3 miles to the southward. The entrance of this river is above 2 miles wide, and the least depth is 1 fathom at low spring ebbs. To sail in, it will be necessary to pass close to the banks which project from the West point, but, at the same time, to be cautious in approaching them, as they are steep-to, and dry at low water. The outer sand will be apparent, even in fine weather, at any other time than high water, and if seen, it may be safely skirted in 2 fathoms near low water, or in 4 at high water; and that you may not get in at the back of this sand, do not bring the highest part of Matacong Island to the westward of N. by W. ½ W., until the West point of the river bears N.E. ¾ E. You may then safely enter, recollecting, as a guide, that you should always keep the western side aboard, off which, however, you will have to edge occasionally to avoid the banks; yet this river is of very little consequence, as a ridge of rocks nearly crosses it at a short distance from its mouth. The ebb tide is here extremely rapid, and the overfalls in the vicinity of the rocks are dangerous to those who do not possess a local knowledge of the river.

The RIVER MELLACOREE, which is at present of considerable importance in the timber trade, has better objects for marks than any of those already described, and the facilities of its navigation are greater, yet buoys are indispensably requisite to make this secure.

For entering the Mellacoree, observe that, at 8 miles off shore, there are 6 fathoms of water; and, with the river's mouth bearing E. by N., it will be fairly open. Steer toward it, in that direction, until the soundings have decreased gradually to about 3 fathoms at low spring ebbs, with the following bearings: East Point of Yellaboi Island, S. by E.: Sallahtook Point, distinguishable by the trees being higher than elsewhere, bearing S.E. ½ S.; Bentee Point,‡ known by a remarkably large tree, E. by N.; the outer point of Tānāh River, E.N.E. ¾ E.; and the rounding of the land to the northward of the river, N.E. ½ N.; you will then be at the spot indicated by the outer *anchor* in the plan, and in the fair way. The MIDDLE GROUND is steep and dangerous, but the soundings on the southern side are gradual, though the mud bank is very wide; borrow, therefore, rather on that side until nearly as far as Bellangsang Point, when you must haul over to the mouth of Tannah River, and there anchor. Higher up, there are some patches of rocks in the middle of the river, but at low water they are seen, as well as the deep water channel between them, which is one-third of a mile in breadth, with a depth of 7 to 9 fathoms. By keeping the East point of the River Tannah, bearing N.W. by W. ¾ W., you may pass through this channel in safety; and, there being no further danger, you may ascend the river to the factories established below Devil's Island, on the South shore; the general depth varies from 5 to 9 fathoms. Here it is high water on full and change days, at 7^h 40′; spring tides rise 11 feet.

Besides the channel on the South side of the Middle Ground, for which directions have been given, there is also an inferior one to the northward; to enter which, when 5 or 6

* See Chart, with the entrances of the Forecarreah, Mellacoree, and Tannah Rivers, by Captain Boteler, published at the Hydrographic Office, 1830.

† In the Table of Positions, the position of Matacong, or Matagong, is given, according to Captain Owen, &c., in lat. 9° 14′, lon. 13° 25′ 30″; but Captain Boteler (1829) gives the house on the North side of the same island in lat. 9° 16′ 10″, and lon. 13° 26′ 20″; and hence, by survey, the latitude of Sallahtook Point will be 9° 3′ 5″.

‡ This point is on the South side of the river, and immediately opposite to another point, on which there are *two* very large trees.

miles off shore, bring the West point of Tannah River to bear E ¾ S., and by carefully using the lead, you may proceed in with safety; for, although at its termination it takes a slight turn round the N.E. corner of the Middle Ground, yet this is generally so well indicated that you can scarcely be deceived.

The TANNAH RIVER, which falls into the Mellacoree, is also navigable, though much smaller, and the tides are not so strong as in the main stream.

On account of the soft nature of the bottom, vessels may ground in several places in the vicinity of the Mellacoree River, without being injured; but a patch of foul ground, which surrounds the long reef off *Sallahtook Point*, must be carefully avoided.

COAST FROM SALLAHTOOK POINT TO BALLO POINT.*

From SALLAHTOOK Point the coast trends S.S.E. 7 miles, to a small river, on the western point of which is situated Sāngăhtōok Factory; and about 1½ miles to the westward of this point is Yellaboi Island, surrounded by mud banks that are dry at low water.

YELLABOI is a low swampy island, nearly 2 miles in length, and covered with trees, which, toward its western extremity, give it the appearance of an abrupt cliff, easy to be recognised; abreast the S.E. extremity of the river there is another small river called Inglis Pāhbŏyĕāh.†

CORTEEMO ISLAND.—Four miles S.E. from Yellaboi we come to a much larger island, with extensive mud banks on the north-westward, but with a deep channel between it and the main; it is called *Cŏrtĕĕmo*, and lies in the mouth of the *Rivers Scarcies*. These rivers are known on the coasts by the names of *Great* and *Little Scarcies*; the former is navigable for large ships, but the other is adapted to very small vessels only, and requires very careful pilotage.

GREAT SCARCIES.—The channel into the Great Scarcies River is the best on this part of the coast; for, although the banks are steep, yet it is broad and deep, and a ship of the line, by taking a proper time of the tide, might moor off the inner point of Yellaboi Island.

To sail into this anchorage, bring the West end or highest part of Yellaboi Island to bear E.N.E. and steer toward it in that direction, until you decrease the depth to 5 or 4 fathoms, which will happen suddenly. Now change the course, and keeping in 4 to 5 fathoms, steer direct for *Inglis Pahboyeah River*, bearing E. ½ N.,‡ taking care to keep it well open of the inner point of Yellaboi Island, until the West point of that island bears N. by E. ¾ E., when you must haul directly in toward it, and skirting along the steep mud bank which borders the South side of the island, steer for its S.E. point, close to which you may anchor in 4½ fathoms. In reaching this anchorage, the least depth you will have to pass over will be 2½ fathoms at low spring ebbs; and this occurs only after hauling in for the island, and running along the edge of the mud bank.

A timber-ship, lying at this place, could easily have her cargo rafted down to her, excepting during the *rains*, when, as affirmed, the strong winds occasion so heavy a sea, as to make it unsafe to lie there with her raft ports open. With little difficulty, however, she might proceed to Kakongkah Island; though the channel is narrow and crooked, and would perhaps require buoys to point it out.§ It would be scarcely possible to give intelligible marks for this winding channel, but it is so apparent in the plan, that by using the boat ahead, and never passing over the 3 fathoms boundary line described therein, except in crossing the three short flats, you can scarcely go wrong; the bottom,

* See Chart, with the entrance of the Scarcies Rivers, by Captain Boteler, published at the Hydrographic Office, 1830.

† Yellaboi, or Yelleboa, according to Captain Owen, as shown in the Table, p. 30, is in lat. 8° 55′ 42″, lon. 13° 17′ 45″. Captain Boteler gives its West end as in lat. 8° 57′ 5″, lon. 13° 18′ 25″. Variation, 18° 4′ W., 1829.

‡ Of *Inglis Pahboyeah River*, the entrance is nearly a league to the North of Cŏrtĕĕmo Island.

§ *Kakongkah* is a small isle in the mouth of Great Scarcies River, having a factory near its western extremity.

however, is so soft, and the water so smooth, that no damage will arise from touching. It is high water here, on full and change days, at 7^h 10′, and spring tides rise 11 feet.

For Captain Boteler's General Remarks on the Coast and Seasons see page 125.

DIRECTIONS FOR SIERRA LEONE, ETC.

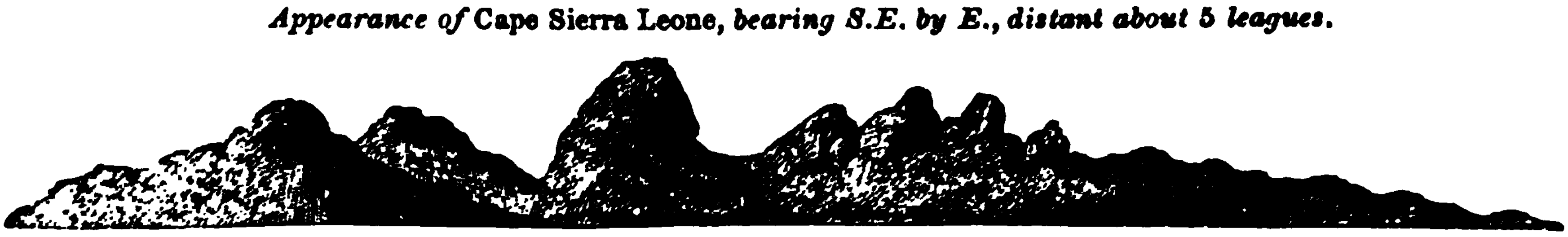
FROM *Yellaboi Island*, mentioned in the preceding page, the CAPE OF SIERRA LEONE bears S. by W. ¼ W. [*South*] 25 miles. This cape, with the coast eastward, forms the South side of the great river, bearing the same name.

The coast northward of the mouth of the river is low and level, bordered with a shoal bank 3 miles in breadth, and which has upon it several dangerous rocks; but on the South side the land rises into hills, which, forming one upon the other, tower into lofty mountains, crowned with perpetual verdure. These are, properly, the *Sierra Leone*, or *Lion Mountains*, which have given name to the river and country. From the foot of the hills, points of land, projecting into the sea, form excellent bays for shipping and craft, and convenient places for hauling the seine.

The mouth of the river, which is 2 leagues wide, is obstructed by an extensive bank, called the *Middle Ground*, but on the South side of this is a safe and deep channel for vessels of any burden. The latitude of the cape is 8° 30′ N.

Vessels bound from Cape Verde to Sierra Leone are recommended to gain soundings in lat. 9° 15′ N. on the grand bank which extends from the Bissagos to Cape St. Anne; and having gained bottom in 50 fathoms, gray sand, on the edge of the bank, to make a *true* S.E. by N. course, keeping in soundings until in lat. 8° 29′ or 8° 30′. Then make an *East* course good, and you will make the land of Sierra Leone, the mountains of which may be seen in *clear weather* 14 leagues off: but as, on this coast, the weather is generally hazy, it is seldom seen farther off than 6, and frequently not more than 4 or 3, leagues; although, at the same time, a good observation may be had. This is occasioned by the constant vapours, caused by the sun, which ascend from the mountains covered with thick woods.

Appearance of Cape Sierra Leone, *bearing S.E. by E., distant about 5 leagues.*



In standing in for soundings, and approaching Sierra Leone, keep the lead constantly going, as the current sets in various directions, but generally tending to the eastward. It is requisite to be very attentive to this particular. Should you be standing in, in the night, in lat. 8° 30′, and shoalen your water from 20 to 18, 13, and then suddenly to 8 and 7 fathoms, you will be at the distance of 3 leagues from the river, and should immediately anchor and remain till daylight.

The danger on standing in for the cape is, the *Middle Ground*, hereafter described, which extends 7 miles from the eastern shore, and nearly to the meridian of the cape, leaving an entrance only 2 miles broad. Having made the land of Sierra Leone, bring the cape, which may be easily known by a small negro town standing upon it, to bear S.E. by S.; then steer directly for it. At this place pilots for the river may be had.

A rock, called the *Carpenter*, lies at the distance of nearly a mile W. ½ N. [*W.S.W.* ½ *W.*] from the N.W. extremity of the cape. This rock always shows itself by the breakers over it, and at half-tide may be distinctly seen. The flood-stream sets directly through between the cape and the rock. You may advance within half a mile of the rock; but those beating down the river, with the sea breeze, and a strong ebb tide, must be careful and give it a good berth, as the ebb tide sets strongly between the rock and the cape. From the cape, a ledge of rocks extends in a direct line toward the Carpenter.

The LIGHTHOUSE on CAPE SIERRA LEONE was completed in 1849, and shows a brilliant fixed light. It stands on the extremity of the cape, and is 69 feet from

the base to the top of the lighthouse. It bears from the Carpenter Rock E. ½ S. by compass, and from the western edge of the middle ground, S.W. ½ S. Vessels, therefore, coming from the westward should be careful not to bring the light to bear more to the eastward than E.S.E. ½ E., and coming from the southward not to alter the course until the light is on that bearing; and coming from the northward, should not bring the light more to the westward than S.S.W. ½ W., until King Tom's Point comes in one with the centre barrack, S.S.E. ¾ E., to avoid the middle ground.

Bearing of the Carpenter Rock, W. 13° 7′ S.

Within the cape the general trend of the coast is nearly *true* East 6 miles, but it is broken by several inlets, which are called *Bays*. Of these, the first within the cape is a small cove, of pleasant appearance, called *Cape Bay;* the next is *Pirates' Bay*, so named from being the place where the pirates formerly used to careen and refit their vessels; the third is *Whiteman's Bay*; the fourth, *St. George's* or *Freetown Bay*, whereon stands FREETOWN, protected on the hill-side by a fort, and above the fort, on the summit of the hill, are the new barracks. On the East of Freetown is *Susan's Bay*, and at a mile eastward of the last is *Thompson's Bay*, bounded on the East by Farran Point. *For the position of Freetown, see the Note 10, on p. 69.**

FREETOWN.†—The general aspect of the country in the immediate vicinity of this colony, and the external appearance of Freetown, give a stranger, on arrival, an idea of salubrity and prosperity, which subsequent experience may not altogether realize, or, at least, reconcile with the result of further observation.

* However pernicious the climate, and very pernicious we know it to be, to the European constitution, the country about Sierra Leone is most beautiful. The following description is from a letter written in 1828. It may be flattering, but still useful.

The entrance of Sierra Leone River, the full view of the town and the Bullom shore opposite, and the magnificent, I may almost say sublime, background, are very striking to the eye of a stranger first approaching this spot by sea. The anchorage is good, and capable of accommodating a large fleet of ships. The export trade, though not very considerable, is rapidly increasing; consisting principally of African timber, gold dust, elephants' teeth, hides, palm oil, honey, wax, arrowroot, and pepper. The imports are almost universal, and solely from England. I have no doubt, judging from the goodness of the soil (which I have closely examined in my rides, and of which my quondam farming pursuits, I may flatter myself, have rendered me a not incompetent observer), the reasonable industry of the black people, whose anxiety to be located upon land of which they are to possess the title-deeds, and from the experiments which have been already made in agriculture here, that the day is not far distant when this peninsula will produce coffee, indigo, and grapes, in great abundance. The coffee is uncommonly fine, the indigo good, and the grapes of a remarkably rich flavour. The establishments of the principal inhabitants, in or near the town, are handsome, large, and in every respect suited to the climate, and most of them present pretty country seats, with gardens and grounds. The middle classes hold good and commodious houses, and the labourers' cottages or huts bear comparison with those of England. Then the everlasting rich foliage is most delightful; equally overshadowing the habitations of the rich and poor. Plantains, pines, bananas, oranges, and limes, may be bought in the highest perfection, at little cost. I am much struck with the constant busy occupations of the liberated Africans; whether labouring in the town or fields, they are seldom idle. How erroneous are the notions entertained respecting this race of men, amongst even well-informed persons at home! It is true, they do not work so hard as the English peasantry in mowing or reaping. In this climate, would you have them work so severely, and with such little intermission? But they do so much within the twelve hours, as to enable them to maintain themselves and their families in comfort, and lay by something besides. The colony has been more healthy during the last than in any previous year. I ride and see everything that is worthy to be examined within 10 miles of Freetown. It is observable, that the people readily submit to a due exercise of authority, and really seem to show that they like to be governed, &c.

In 1826, Captain Owen estimated the population at about 20,000; but, as he observed, the liberated males of the negroes exceeded the females by, at least, five to one, so that there was no probability of a speedy increase.

The towns, or rather villages, inhabited by the liberated slaves, under the direction of Church missionaries from England, are named *Glocester*, *Bathurst*, and *Leopold*. These places are situate more than 1,000 feet above the sea, yet in the most sultry part that could have been chosen, being a deep valley surrounded by lofty hills, which reflect the sun's rays, and interrupt the free current of air, so essential to health.—(*Captain Owen.*)

† Parliamentary Report, 1842, Part II., p. 244, &c.

Its more striking features are the largeness of the scale on which the public buildings are constructed; the wideness of the streets, and the regularity of their lines; the number of stone houses, and the excellence of the roads; the abundance in the markets, the multitude of well-dressed negroes in these places, the variety of stalls and shops in their own quarter, well supplied with British goods; the cleanliness and the comfortableness of their small abodes, the size and structure of the principal church, and the numerous chapels and schools in the town and suburbs; and last, though not least, the admirable order that seemed to prevail amongst the negro population, without any apparent exercise of magisterial severity, or rigour of political restraint, to repress or control the people.

From ten o'clock in the morning till five in the evening a white man is seldom seen abroad; at the latter hour, the race course and the promenade on the battery are frequented by equestrians and pedestrians; and, perhaps, no circumstance that strikes the attention of a stranger, makes so strong an impression on his mind as the general expression he observes of languor and debility in the looks of every individual he meets of European birth (with perhaps two or three exceptions) in the colony. The young and old, the acclimated even as they are deemed, who have had their seasoning, either in one fever, or the periodical return of that malady, and have survived these attacks, show plainly enough the baneful influence of the climate, which leaves the features without vivacity, the frame without vigour, and the whole constitution apparently deficient in vitality.

The settlement at Sierra Leone was formed in 1787; and the new colony occupied a tract of about 20 miles square, and was peopled, in part, by negroes from America; and was increased by various additions from the West Indies.

In 1791, the tract of land that was ceded by the native chiefs, in 1787, to the British sovereign, was made over to the Sierra Leone Company; and, in 1796, Governor Macaulay enlarged the limits by an additional quantity of land towards the sea-side on the western boundary, obtained from a native chief called King Tom; possession of this was finally gained in 1801. At this period the colony did not extend beyond the peninsula, which is about 18 miles long and 12 broad. In 1824, a new sovereignty of the territory was purchased of the chief of the North Bulloms, on the North side of the Sierra Leone River. We have derived this statement from Dr. Madden's report; but in Colonel Doherty's remarks upon it, he states, that the limits of the colony are strictly confined to the peninsula.

The *Middle Ground*, already mentioned, forms the North side of the channel into the river, which is half a league in breadth. The general depths in the channel are from 6 to 10 and 12 fathoms. From the cape the extremity of the Middle Ground bears N.E. ¼ N. [*N.N.E.*] 2 miles, and the bank extends thence eastward to the Bullom shore. The ground is, in general, composed of hard sand; and, in some parts, large stones. It dries, in several places, at about the middle of half ebb; and, at all times, the sea breaks over it. On its eastern part there is a channel, but it is fit for small vessels only.

The *Bullom shore*, which forms the North side of the entrance of the river, is level and covered with wood. On this shore, in lat. 8° 40′, is an islet, called *Leopard Isle*, whence the coast rounds to the south-eastward, nearly 12 miles, to *Tagrin Point*, and between are eight negro towns, of which the fourth, from the northward, is that of the King of Bullom. The edge of this coast is low, swampy, and bordered with shoals.* In the river, eastward of Tagrin Point, is *Tasso Island* and several smaller isles, the formation of which can be understood only by reference to the particular chart.

Ships from the northward, when bound to Sierra Leone, should be careful how they approach the cape. They must keep their lead going, and not approach any nearer than 6 fathoms, until they see the high land. No one should stand in for the cape until he gets that high land to bear E.S.E. ¼ E. [*East*], and, when he is 6 leagues off, he will see the cape making in a small low point, with a ridge of cocoa-nut trees close to the water's edge; and when within 3 leagues of the cape he may observe the Carpenter Rock, with

* This swampy coast has been thought, by some, to be the origin of the unhealthiness of the opposite shore of the river, and Freetown. It has been proposed, by some one, to erect lime-kilns on this coast, in order that their fumes might counteract the noxious miasmata arising from the shores and mangroves! It need scarcely to be said, that the insalubrity of the colony does not arise entirely from such a cause.

the sea constantly breaking over it. You pass the cape within a quarter of a mile, in 9 or 10 fathoms. You will now open the first cove, called Cape Bay, and thence pass Pirates' and the other inlets which have been described. In all these bays excellent fish may be caught with the seine, and sometimes green turtle.

Having passed the cape as above, your course will be S.E. by E. ½ E. [E. ¾ S.] up the river; this leads clear along shore to Freetown, which is 3¾ miles from the cape. The general depths will be 12 to 18, 13, and 14 fathoms. In working to the northward, advance no nearer to the Middle Ground than in 7 fathoms.

To anchor off Freetown, bring the fort (*Fort Thornton*) to bear S. by W.; the East point of the bay, S.E. ½ E.; King Tom's or the West Point, W. by N., off shore a quarter of a mile, 15 or 16 fathoms, with mud. Moor with the best bower to the eastward. The watering-place here is very convenient, and the water excellent. You fill your casks in the boat, with a hose, which leads from a cascade.

In sailing up beyond Freetown to *Farran Point*, or farther eastward, you will find regular soundings, 14 to 16 and 17 fathoms. You may make free with the shore all the way up, as it is very bold.

Farran Point is remarkable. It is elevated, and has a house on its summit. In hazy weather, several vessels, on coming in, have mistaken this point for Cape Sierra Leone, although it is nearly 2 leagues eastward from the cape, and have thus touched on the Middle Ground. But Farran Point serves as a good mark for the mid-channel, between the Middle Ground and Carpenter, when kept well open to the North of the cape, and bearing S.E. by E. ½ E.

Vessels coming in more from the northward will clear the West end of the Middle Ground in 3½ fathoms, with King Tom's Point (West of Freetown) on with the central barrack, bearing S.S.E. ¾ E. [*S.E. ½ E.*]

The *tide* at Freetown flows, on the full and change days, at 7^h 50′, and rises 12½ feet.

During the rainy season the tide is very regular and strong, running 6 and 7 knots an hour, and the ebb sets rapidly on the Middle Ground. In the dry months it commonly flows on shore at 7^h 30′, with seven and a half hours' ebb, and four and a half flood. In this season the ebb runs 2½ miles an hour, the flood only 2.*

SIERRA LEONE to CAPE ST. ANNE, &c.—From the Cape of Sierra Leone the coast, at the foot of the mountains, forms a slender sandy bay, bordered with trees, which extends more than 3 miles to the southward of the cape, where it terminates in a rocky point. At three-quarters farther is another point, more conspicuous and projecting, named the *False Cape*. The last bears from Cape Sierra Leone S. by W. ½ W. [*S. ¼ E.*] distance 4 miles.

From False Cape to York, or the Sisters' River,† the coast trends irregularly S. ¾ E. [*S.S.E. ½ E.*] 12 miles; and from York to Cape Chilling, S. ½ W. [*S. by E.*] 7 miles.

At Cape Chilling the hills of Sierra Leone terminate, after having made a high double land, which is seen a great way off; the mountain near the South is of a prodigious height, its summit being perpetually covered with clouds, and can be perceived at the distance of 14 or 15 leagues. The cape itself is low, and covered with trees; and, at 4 or 5 leagues off, appears like a small island.

One of the boats, employed in the survey under Captain Owen, was driven on rocks extending from Cape Chilling, and was totally destroyed, the people, with great difficulty, being saved. Upon this cape is *Kent Town*, a village of liberated Africans and disbanded negro soldiers, having a school composed of 164 boys and 70 girls; but, as no sure market exists for their industry, they raise little from the soil except for their own use. This village is delightfully situate on the side of a hill, with a large house for the superintendent, who is also schoolmaster. He resides on the first floor, the lower part being made use of as a church.—*Captain Owen*, 1826.

BANANAS.—Off Cape Chilling, and separated by a space of 2 miles in breadth, lie the BANANA ISLES. The outer or S.W. end of these isles is 7 miles S.W. by W. ¼ W. [*S.W. ½ S.*] from the cape. The greater part of their coast is foul and rocky.

* Directions for sailing from the Bight of Biafra to Sierra Leone have been given in treating on the Currents, page 206.

† Otherwise *Agaltoopant*, or River of the Twin Sisters.

The Bananas very much resemble the Isles de Los, but the land is more elevated. They are extremely fertile, and have plenty of water, but no running streams. Wild cattle are abundant upon the greater isle. It is a remarkable fact, that pigs are the only domestic animals that cannot be propagated here; as there appears to be some herb, of which they are inordinately fond, but which is fatal to their existence.

A few years ago H.M. ship *Tartar* anchored off Cape Chilling and to the northward of the Bananas, with the N.E. point of the isles S.S.E. ½ E., and the western part S.S.W. Between the ship and islands the water deepened to 8, 9, and 7 fathoms; but within a cable's length of the shore, between the westernmost island and the next, there was found a depth of only 2 fathoms. The westernmost islet was then inhabited by only one Frenchman, *Jean Baptiste Major*, and his four slaves.

East Point, S.S.E. ½ E. * *West Point, S.S.W.*

The Bananas appeared as above, from the *Tartar's* anchorage, at the distance of 4 miles.

There is anchorage as well to the southward as to the northward of these isles, but the best is said to be in 5 fathoms, about 2 miles from shore, on clear clayey ground, with the N.E. point S. ½ E., and the highest hill S. by W. ½ W. There are sandy bays, which may be seen from the anchoring-place, and where you may land; but the best is at the S.W. end. Wood and water are obtainable here. The watering-place, which is close to the beach, has a very good run of water.

Mr. Woodville has said, " It is very evident that the whole chain of mountains called Sierra Leone, as well as the Isles Bananas and the Isles de Los, are the productions of volcanoes, if we are to judge from the great quantity of lava found there, and from the small pieces of it taken up by the lead, in sounding, at certain distances from the land, opposite to these islands, and nowhere else; also from the conical figure of many of the hills, and from the ferruginous soil in the country."

Yawry Bay.—At 6 leagues S.S.E. [*S.E. ¼ S.*] from Cape Chilling is *Point Tassa.* The coast between forms *Yawry Bay*, the shore of which is bordered with a shoal 4 miles broad, having on it many oyster beds. Great part of the bank is uncovered with the ebb, and has only 4 feet over it at high water.

Off Tassa Point is a group of islets and rocks, called the *Plantain Isles* and *Bengal Rocks*, which extend from the point 5 miles westward, on the flat between Yawry Bay and Sherboro Inlet.

Tides.—The tides divide off the False Point of Sierra Leone. To the northward of that point the flood runs to the northward; to the southward of that point it sets to the South. Hence at the Bananas the flood is from the N.W., and the ebb contrary. Here the tide flows, on the full and change days, at 8^h 15′. During the equinoxes it rises 9 or 10 feet perpendicular; other spring tides 8 or 9 feet. At the Plantain Isles it rises about a foot and a half more than at the Bananas; but, at the Bashaw or Turtle Isles, more to the southward, the rise is 6 or 7 feet, common spring tides.

SHERBORO INLET.—The Inlet or Sound of Sherboro, commonly called Sherbro River, is between the island of that name and the main land. The westernmost headland of the island is *Cape St. Anne*, in lat. 7° 34′, and nearly on the meridian of Point Tassa, which lies in lat. 7° 55½′.

From Point Tasso the coast, forming the North side of Sherboro Inlet, trends 12½ miles S.S.E. ½ E. [*S.E. ¼ E.*] to the mouth of a river, the *Yallucka*, and thence it winds to the south-eastward, 6 leagues farther, to the *Bagroo River*. It is bordered by a mud bank, off which are several shoals, the positions of which can be understood only by reference to the particular chart.

The South shore of Sherboro Inlet is the North shore of Sherboro Island, which is 3 leagues in extent, from *Cape St. Anne* on the West, to *Jamaica Point* on the East. On this shore, at 12½ miles eastward from Cape St. Anne, is the spot and remarkable tree called *Little Pow Grande*, and 3¼ miles more to the East is *Pow Grande.* At a league and a half eastward of the Pow Grande, on the shore, is *Jenkins'* Village, off which is

the general roadstead for large vessels, having 5, 6, and 7 fathoms of water. All the shore between this and Cape St. Anne is bordered with an extensive mud bank.

BASHAW or TURTLE ISLANDS.—On a great flat, which extends more than 4 leagues to the N.W. from the western end of Sherboro Island, is a group of eight or nine islets, called the *Bashaw* or *Turtle Isles*, which are evidently the remains of a considerable tract of land now submerged by the sea. The bank on which they exist also exhibits innumerable ridges, knolls, blind channels, and pools; but is navigable on almost every part by large boats at high water, and at low water by light boats and canoes.

DIRECTIONS FOR SHERBORO INLET have been given as follow:—From off the West end of the Bananas, steer toward the Bengal Rocks S.S.E. ¾ E. [*S.E. ¼ E.*] 14 miles, and so as to give them a berth of about a league: having rounded these rocks, steer S.E. ¾ S. [*S.E. by E.*] 5 leagues, taking care to avoid the hard sand bank on the East, which is steep-to. In running on, you may shoalen your water to 4 fathoms, on the flat of Yallucka River, upon the eastern side, and thence continue the same course, 4 leagues farther, to the southern bank, making due allowance for tide, whether ebb or flood. The last course will lead to 1½ miles from shore, in about 4 fathoms of water, and without the edge of the bank. You may now run up along shore, for 2 leagues, to *Jenkins*, taking care to avoid the edge of the Middle Ground on the North, which here leaves a channel of only half a mile between it and the shore.

BANK and SHOALS of ST. ANNE, &c.—The BANK of ST. ANNE, which has not yet been thoroughly surveyed nor defined, may probably extend from the parallel of 8° to 7° 31½′ N., and from lon. 13° 6′ to 13° 32′. The northern limit, as shown in the Table, p. 30, is 7° 56′: this is the limit to which the bank has been *actually surveyed*; so likewise the western limit is given in 13° 29′, where there are 10 and 12 fathoms of water; but 13 fathoms have been found at 7 leagues more to the westward, upon the general bank of soundings extending from shore; and there is a spot of 8 and 9 fathoms in about 7° 56′ N. and 13° 48′ W.*

Upon the Bank of St. Anne are a number of small and dangerous insulated shoals, separated by channels of 6, 7, 8, and 10 fathoms. The bank itself is divided from that of the Turtle Isles by a narrow swashway, having 5, 6, and 7 fathoms.

But it appears that a vessel bound from Sierra Leone to the Windward Coast will clear every danger by proceeding over the great bank S.W. ¾ W. [*S.W. by S.*] 12 leagues to the parallel of 8° N.: and thence, on the meridian of 13° 40′ to lat. 7° 30′, from which point a course S.E. by E. ½ E. [*E. ¾ S.*] 22 leagues, leads to the *Shebar*, or Bar of Sherboro River, at the S.E. extremity of Sherboro Island.

Captain Midgley recommends that "in the wet season vessels should give the St. Anne shoals a large berth to the eastward, as the current, as well as the sea, runs with great velocity into the bight of Cape Mount, and vessels which may unfortunately happen to fall in with the land to the northward of Sinou, in the wet season, will find considerable difficulty in working to the southward.†

When *Lieutenant Badgley*, with other officers and two boats, in 1826, proceeded from Great Turtle Island, in order to survey the southern part of Sherboro Inlet, they found a good channel, with about 6 fathoms, but the atmosphere was so thick that the object was totally defeated. The colonial squadron was then at anchor at the *Shebar*, where was formerly the establishment of the infamous *James Tucker*; but which, the country having been ceded to the English, by the old King of Sherboro, had been deserted, and he had removed to the River Kittam, about 26 miles from the sea. From the old establishment the French and Spaniards had been in the habit of shipping annually about 20,000 slaves, collected from the three great rivers, *Bagroo*, *Dean* or *Jong*, and *Kittam*; but as, by the occasion of this territory, the British authority extended from Sierra Leone to the *River Galinhas*, the slave trade was rooted out from the Sherboro, the most extensive mart upon the Grain Coast.

The *Boom Kittam River* runs in a parallel direction with the shore, at a distance from it of 1 or 2 miles. The strip of land between, called *General Turner's Peninsula*, is 8 leagues in length, and it is terminated by the Forks, in lon. 12° 8½′ W. (See Table, p. 30.) At 6½ leagues farther to the S.E. is the *River Galinhas* or *Gallinas*.

* *Journal of the Tartar*, by the late Mr. Finlaison.

† *Nautical Magazine*.—Captain Midgley, "On a Voyage to the Gold Coast," Jan., 1843, p. 27.

GALLINAS.—The bar of this river* is only passable for large boats or small coasting craft, and is very dangerous during the rains, when it is frequently impassable. During the dry season it may be generally passed with safety, excepting occasionally at the full and change of the moon, which has a very marked effect upon the surf on the whole of this coast.

After passing the bar, the river opens out into a spacious sheet of water, about 3 miles across in every direction, which is studded with islands lately occupied by the slave dealers, and affording very favourable situations for trading factories.

From hence the river runs, in three branches, to the north-westward, to the northward, and to the N.E. The first, during the rainy season, joins the Boom Kittam River, thus affording a direct inland water communication with Sierra Leone; but, in the dry season, about 8 miles, is too shallow for canoes to pass. The next branch runs past the town of Ghindamar (where the king resides), 9 miles from the sea, and is navigable about 5 leagues for large canoes. The third branch runs close inside the sea-beach to the S.E., about 4 miles, and then turns suddenly to the N.E. at a place called Soolimane; from hence it is navigable for large canoes about 7 miles. This branch forms the S.E. boundary of the Gallinas territory. To the N.W. it terminates at a place called Casi, on the banks of the first branch, known by two conspicuous round trees, which form the principal landmarks in this quarter. These limits comprise about 12 miles of sea-coast.

The chiefs describe their territory as spreading out very much and running far into the interior, where it is said to be more fertile and populous than the district near the sea, which appeared to me to be thickly peopled.

When the English slave trade was abolished, considerable traffic sprung up, and was rapidly increasing, when the Spaniards commenced the slave trade in about 1817. From that time legitimate commerce gradually withered, and was at length totally annihilated by the establishment of a permanent slave factory in-shore, about fifteen years ago, by Pedro Blanco, at that time mate of a slave vessel. Since then the slave trade has been the only pursuit, and during the long period that has since elapsed, not enough produce has been exported to form the cargo of the smallest coasting vessel.

Cattle, formerly abundant, are now extremely scarce. Beef cannot be purchased under 1s. 6d. per pound; and for rice, the principal article of food, and once a considerable article of export, they now depend upon the Sherboro and Plantain Islands.

The following list of articles, which, they assure me, would find a ready market, appears to me to prove that the necessities of civilized life are in sufficient demand to ensure the cultivation of their national resources now they can be no longer obtained through the medium of the slave factories:—flour, wine, tea, coffee, rum, butter, cheese, tobacco, hats, clothes, shoes, coral, muskets, knives and forks, beads, trinkets, glass, crockery, powder, brass pans for making salt, hardware, and cotton and linen cloths of all descriptions.

The Gallinas has become one of the most notorious places on the West coast of Africa, from the great share it has had in the slave trade, and the means recently taken by the British cruisers for its suppression.

The proceedings against the slave dealers commenced in September, 1840, when information was sent to Sierra Leone that two British subjects were held as slaves in the Gallinas; Captain the *Hon. Joseph Denman*, in H.M. sloop *Wanderer*, accordingly landed on November 19th, 1840, at Dombocorro, the slave factory nearest the bar, and demanded redress of King Sciacca and the native chiefs. They then commenced collecting the slaves, and between the 22nd and the morning of the 26th, upwards of 880 were received, being all that were in the barracoons in the vicinity, and they were then sent to Sierra Leone. During this time the slave factories at Paisley, Jeinbo, Minna, Jeekree, Comassoon, Comabindo, Teiro, and Dombocorro, were burnt to the ground.†

* Description by Captain the Hon. *J. Denman*, R.N., H.M. sloop *Wanderer*, December, 1840. Parliamentary Report, Appendix, pp. 460, 461.

† This proceeding led to an unusual trial "at bar," in the Court of Exchequer, in February, 1848. M. Buron, the chief slave dealer, claimed compensation for £180,000 of Captain Denman, on the ground of his not being a British subject; the British Government defending the case. The jury gave a verdict for the defendant, and this gave a heavy blow to the slave trade.

The enormous extent of the slave trade at this place may be imagined from the number of factories of large extent, all occupying different islands or points in the river, and belonging to distinct houses at Havanna. It is impossible that the average exportation per annum can have been less than 15,000.

In consequence of the previous and subsequent strict blockade which was maintained by our cruisers, it may be considered that these rigorous proceedings have completely annihilated the traffic in the Gallinas; and the neighbouring ports of Bissao, &c., are benefiting by the removal of a portion of the trade, as was stated in the description of those places.

THE DESCRIPTION OF THE COAST OF GUINEA, from the River Gallinas eastward, with directions for the same, is given in the *Sailing Directory for the Ethiopic or Southern Atlantic Ocean*, Third Edition, 1844, p. 324, &c.

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3. THE AZORES, OR WESTERN ISLANDS.

The AZORES, OR WESTERN ISLANDS, are nine in number, and named Santa Maria or St. Mary's, St. Miguel or St. Michael's, Terceira or Tercera, St. Jorge or St. George's, Graciosa, Fayal, Pico, Flores, and Corvo. The land is, in general, high; the coasts steep and rocky.

These islands are said to have been discovered about the middle of the fifteenth century by Joshua Vanderberg, of Bruges, in Flanders, who, in a voyage to Lisbon, was driven to them by stress of weather. At Lisbon, he boasted of his discovery; on which the Portuguese, in that spirit of enterprise so strongly manifested by them at this period, set sail and took possession of them, calling them *Azores*, or *Isles of Hawks*, from the many hawks and falcons found amongst them. It appears that they were entirely destitute of inhabitants, and of every animal excepting birds. The latter were numerous and of various species.

Antonio Gonzalo says, that the great Don Henry, Prince of Portugal, considered these isles as so considerable an acquisition, that he went in person to take possession, in 1449. This was forty-three years before Colombo landed in America. And, it has been affirmed, that the Flemish merchants, on the part of their countrymen, sent a colony thither, many of whose descendants continue in Fayal to this day. Hence the isles have been also called *Flamingos*, or *Flemish Islands*.

The capital of the Azores is *Angra*, in Terceira, the residence of the civil governor; but the general residence of the bishop is in the Island of St. Michael.

The inhabitants, generally, have been described as an innocent, good, and honest people, who prefer the olive to the laurel, and who would seek for distinction rather by industry than by arms. The climate is delightful; the air generally clear and serene; the soil so prolific, that both European and tropical plants arrive at the greatest perfection: the face of the earth is, however, so diversified, as in some places to exhibit, within a small extent, volcanic hills and productions, gardens of aromatic plants, pastures, vineyards, orangeries, &c. The greatest inconvenience of these isles is, their having been subject to eruptions and earthquakes; and, in some parts, where the coasts are low, the sea has, at times, overflowed the land, and occasioned considerable mischief. Yet, in the cultivated parts, the lava, once a stream of fire, is planted with oranges, lemons, and vines; and the land, formed from the decomposition of volcanic substances, is sown with Indian corn, small beans, and wheat. The islands still abound in waste lands, fit for the cultivation of hemp, the vine, &c.

Being generally mountainous, they may be descried from a considerable distance; particularly the peak on the Isle of Pico, noticed hereafter, which may be seen more than 20 leagues off.

It cannot be doubted that this archipelago must be considered as an immense ridge, on which craters are thrown up so as to form islands. The Island of St. Mary, the only one not situated in the general direction of the others, is not volcanic; no part of its surface appears to have suffered from heat or eruption, subsequent to its formation. The

Island of Pico is elongated from S.E. to N.W. in the same manner as all the other islands, St. George, St. Michael, and Terceira; and Flores and Corvo lie exactly in the same direction. Fayal appears to be nothing more than a part of Pico, for the general direction of these islands and their shores perfectly corresponds; and St. Michael's and Terceira appear to be connected by an intermediate range of volcanic formations, as will be subsequently seen. Few places offer such a variety of volcanic phenomena as St. Michael's; and the history of the eruptions and earthquakes on and near it give ample proof of the violence of the subterraneous forces over which it lies. In the descriptions of the separate islands will be found notices of the principal volcanic phenomena that have been recorded. The reader is directed, for a more complete description of the volcanoes, &c., of the Azores, to an article in the *Nautical Magazine* for 1841, page 752, consisting of extracts from the *Philosophical Transactions*, and *Von Buch's Descripcion Phisique* of these islands.

WINDS AT THE AZORES.—In the former part of this work, in the section treating on the subject, we have given descriptions of the general phenomena of the winds and hurricanes of the Atlantic, and the laws by which they appear to be governed, as deduced from the numerous and careful observations that have been made at various times. In connexion with that system of aerial currents, and their perturbations, we have reserved the consideration of that part of the subject which is connected with the Azores and their vicinity. It will not be necessary to recapitulate any of the principles or statements which have been before given, but must refer the reader to that division of the subject, as detailed in p. 135, and following.

Similar hurricanes to those there mentioned seem to be prevalent at the Azores, and in some measure to be governed by the same laws. This it will be very important for the mariner to know, and therefore the following observations, by Mr. *T. C. Hunt*, the British consul at St. Michael's,* will be very interesting:—

"The regularity with which gales enter these seas in the north-west quarter, and, after crossing them, disappear at the south-east, is a circumstance the knowledge of which may be highly serviceable to the commanders of ships sailing across the Atlantic.

"The centre of a gale, in its approach, always effects a descent on the barometer,† and a change in the fall of rain. In its actual passage over the instrument, the descent generally reaches 28·50, from which a rise of one-tenth appears to take place for every 10 miles' removal of the centre; so that the number of miles' distance from the centre of an approaching gale might, perhaps, be indicated by the number of hundredths shown by the barometer over the extreme of 28·50.

"The difference in the *fall of rain*‡ has also its regularity, the approach of the centre bringing a temporary increase, and then a cessation of the rain, which is renewed, and, in a reversed order, diminished on the removal of the centre. According to the observations made at this office, there appears to be in every gale of wind a zone of rain about 120 miles in breadth, heaviest on the inner edge, which is about 60 miles distant from the centre; that the fall of rain decreases in proportion to the distance from this line; and that the fall on the inner edge, being about twelve-hundredths of an inch per hour, the decrease is about one-hundreth for every 10 miles of removal.

"In order to follow out the views of *Colonel Reid*, the British consul and the vice-consuls at the Azores kept regular daily tables of the direction and force of winds, between May, 1840, and Nov., 1841; and the courses of twenty gales which occurred were compiled from them, and the details of them are given in the *Nautical Magazine*, as before quoted."

From the particulars of these twenty gales, of which the courses have been accurately observed during the years 1840-41,§ there appears to be some general conclusions which may be deduced. The first circumstance developed by the inquiry is, the general

* *Nautical Magazine*, March, 1842, page 145. † See page 136.

‡ In the Azores a southerly wind creates great humidity in the atmosphere; a northerly wind removes it. Under the former influence, there is frequently two per cent. of water in the air; under the latter, less than one.—(*See also page* 136.)

§ The commencement of these gales was on the following days, viz.:—1840, June 4th, Aug. 19th, Oct. 3rd, Oct. 7th, Oct. 9th, Nov. 2nd, Nov. 11th, Nov. 14th, Nov. 28th, Dec. 1st, Dec. 6th, Dec. 11th, Dec. 15th, Dec. 27th; 1841, Jan. 11th, Feb. 3rd, Feb. 11th, March 6th, March 19th, Sept. 8th, and Sept. 18th.

direction of storms passing across the Azores. The coincidence of this course with the Great Atlantic Current, which is a continuation of the Gulf Stream, which may every day be traced to the neighbourhood of the Azores, and which the sudden rise of water in those islands (where, having been hastened by a gale, it is suddenly checked in any locality by the operation of the wind, accompanied by a diminution of atmospheric pressure) proves to be sensibly carried beyond them, goes very far to identify the Azorean streams with the tropical gales and hurricanes traced in the able work of Colonel Reid, from the South American coast, along the course of the Gulf Stream to Cape Hatteras, in North America. There is a further resemblance in their diameters. In the chart which Colonel Reid has composed of the great hurricane of October the 10th, 1780, the diameter given to it, in the latitude of the Azores, is about 550 miles. Of the Azorean gales under consideration, four were about this diameter, eleven of about or under 650, and five under 900.

With respect to navigators, for whose benefit these inquiries are chiefly intended, the use which may be made of this knowledge of the courses, taken by storms across the Azores, is in the direction of vessels which may be reached by them. It seems probable that if a ship were caught by a violent gale in the current of the Gulf Stream, near the Azores, her best course would be to steer, so far as the veering of the wind would allow, due North or South; that if she steered to the eastward, she would accompany the gale, and be overtaken by the greater violence of its centre, and that by steering to the West she would sooner meet the centre, or run into a new gale.

Whatever may be the cause of the occasional deflection of the Azorean storms, whether it arises from collision with another storm, or from atmospheric gravitation (the radiation of heat from the islands being always very great), the uniform effect appears to be a diminution of their progressive velocity, and frequently an increase of their rotary force.

But as far as these effects can be foreseen, from a knowledge of the deflection (presuming it always to be accompanied by a slower progression), it is worthy of observation, that the deflection never appears to take a turn to the northward, but always to the South. If this be true, the safest course for a ship in these gales is to the North, unless there are very cogent reasons for a departure from this presumed rule.

ST. MICHAEL'S.—The Island of St. Michael appears to have been originally a plain covered with beautiful trees, rich verdure, and aromatic plants; at the present time, however, it consists of a number of mountains, hills, and declivities, which are evidently the production of volcanic eruptions. The mountains and hills clearly indicate, by their conical figure, and the cavity at their summits, their being the production of fire, and bear unequivocal marks of the effects of this destructive agent, in an accumulation of lava, scoriæ, and volcanic sand.

Externally, the volcanoes appear extinguished, but they are supposed still to burn internally and invisibly. Of this, *Caldeiras*, or fountains of boiling water, in the Valley of Furnas and other parts, are evident symptoms. There have existed three principal craters, whose vertices now form three great lakes, situate toward the centre and the northern and southern portions of the island. From those craters vast mountains have been thrown up; and, in proportion as these ceased to vomit forth matter, partial eruptions burst out, and formed the lateral hills and declivities, which extend themselves in every direction from the mountains surrounding the lakes. The cessation of fire from the different craters has been attributed to water, which appears to have gained access to each, and suddenly extinguished the effervescence of its mineral contents: and the fire now seems confined to stations, where it operates only in boiling the water with various degrees of activity and force.

The island, at length, seems to be of such a structure and confirmation, that the waters pass freely throughout its volcanic caverns, and are easily forced out without shaking or disturbing the earth. Of these extinguished craters, that (the Sette Cidades) in the N.W. part of the island is the largest, and is about 3½ miles long by 2 miles broad. The interior is occupied by two lakes, and the ridge bounding it is nearly of equal height throughout, except where it rises into peaks, and on the N.W. presents a gap between two hills, 1,620 and 1,770 feet high. The second crater is about 3,060 feet high, and is called the *Agoa de Pao;* it is in the middle of the island, and situated in a large mass of pumice stones. *Agoa das Furnas* is the third crater, 995 feet high, and in it are the hot-water springs, but it is not so high as that of *Alagoa Grande*. From Agoa das Furnas the mountains of pumice-stone continue higher, forming a continual range as

far as the *Pico de Vara*, the highest of which is 3,560 feet above the sea, and is the only summit on the island where snow is found.

After Gonzalo Velho Cabral had succeeded in establishing a colony in the Island of St. Mary, discovered in 1431, he landed on the N.W. coast of St. Michael, in 1444, and the extensive plains he saw appeared to him to be so capable of being highly cultivated that he returned immediately to St. Mary to make preparations for colonizing his newly-discovered country. But when he went there the following year, with everything necessary for the establishment of his colony, what was his surprise when, in the place of the plains, he found an enormous mountain, which had been elevated on them, with an immense crater. This mountain is called the *Alagoa de los Sette Cidades*, on which are the two lakes, *Lagoa Grande* and *Lagoa Azul*, as mentioned before. After the elevation of this great mountain, the island remained tranquil until 1522, when an eruption overturned the two hills *Sorical* and *Rubical*, and entirely destroyed the town of Villa Franca, and 4,000 inhabitants also lost their lives. In 1563, an eruption occurred of the *Pico Sapadeiro*, and a large current of lava ran into the sea on its North side. In 1591, seven shocks of earthquakes occurred, and Villa Franca was again destroyed. In 1638, the island to the West was found as described elsewhere. In 1652, some hills near Ponta del Gada threw up an immense quantity of stones and cinders, spreading destruction around. In 1691, after some very violent earthquakes, several small islets appeared not far from the coast. In November, 1707, a torrent, attributed to the breaking of a waterspout, fell on Ponta del Gada, and caused great damage. In 1719, a new island appeared in the West, also mentioned hereafter. In 1720, a succession of violent earthquakes injured the towns and villages, and shook down great rocks from the cliffs, &c. In 1744, October 5, another fall of water occurred, washing down the valleys of Povoaçao and Fayal de Leira, carrying away great parts of two villages. The cause of these floods, not now unknown, is still unexplained. The great Lisbon earthquake in 1754 was also felt here, but there was no eruption. In 1806, a mass of rock slipped from the valley of the Furnas, leaving a chasm 100 yards in diameter; and in 1811 a similar fall occurred close to the same place. The eruptions of August 11, 1810, and of Sabrina Island, June 13, 1811, are described below. In 1838, another landslip occurred at the Furnas. In 1839, December 5, a rise of the sea, like that in 1755, washed down several houses, &c., on the South coast. The last earthquake which was felt here was that which devastated Terceira, in June, 1841, of which a description is given in the notice of that island.

The circumstances attending the formation of Sabrina Island are described as follows: the island had previously been apparently quiescent.* In the early part of the year 1811, a most awful and tremendous explosion of smoke and flames issued from the sea at the distance of half a league from the shore at the western end of the island. From the depth of about 40 fathoms, in the ocean, issued smoke, fire, cinders, ashes, and stones of an immense size. Innumerable quantities of fish, some nearly roasted, and others as if broiled, floated on the surface of the sea toward the shore. Thus a dangerous shoal gradually formed.† On the 10th of June, the crew of the *Sabrina*, British sloop of war,

* The approximation to an eruption has, however, at times appeared to have been very close. On the 11th of August, 1810, at the hour of ten p.m., slight shocks of an earthquake were felt, which continued, at intervals of a few minutes, for four hours. Between two and three o'clock next morning, a dreadful rocking was experienced throughout the whole island; several houses, unable to resist its violence, were thrown down, and many others were greatly damaged; and such persons as sought safety in the open air were dashed to the ground. On the eastern side of the island an orifice was discovered, resembling the crater of a volcano, and out of which flames occasionally burst forth; but they do not appear to have been accompanied by any ejection of volcanic matter.

The original account of this convulsion stated, that the village of Cozas was swallowed up, and that a lake of water remained in its place; but we have been informed, on the most respectable authority, that "no such village as Cozas ever existed in St. Michael's. The shocks felt in 1810 and 1811 did considerable mischief at the Mosteiros and parish of Ginetes, at the West end of St. Michael's, throwing down many houses, church steeples, &c.; but no lives were lost."—(*St. Michael's, October 7th*, 1818.)

† The flames were first seen in the night of the 1st of February, but invisible indications of its operations had been felt in shocks on the island from the middle of the preceding year. Its observed situation was S.W. of Point Ferraria, and due West from the Pico de Ginetes, at about 1½ miles from the nearest shore. The brig *Swift*, with all her crew, were lost on this spot, before the existence of the shoal was known.

observed two columns of white smoke arising from the sea, which they supposed to arise from an engagement, and made sail toward it, but were disappointed by the wind's dying away. The smoke continued to ascend, with volumes of flame, and they then concluded it was a volcano. Next day they were close in with the land of St. Michael, and found the volcano still raging. They learned, on the island, that smoke was first observed on the 13th of June; two or three days previous to which there had been felt repeated shocks of earthquake in the capital of St. Michael, which threw down several cottages and portions of the cliff toward the N.W., so that destruction was feared on the island; but these ceased so soon as the volcano broke out. On the 18th, the *Sabrina* went so near to the volcano as she could with safety, and found it still raging with unabated violence, throwing up, from under the water, large stones, cinders, ashes, &c., accompanied with several severe concussions. About noon, on the same day, they observed the mouth of the crater just showing itself above the surface of the sea, where there were formerly 40 fathoms of water. At three p.m., same day, it was about 30 feet above the surface of the water, and about a furlong in length. On the 19th, they were within 5 or 6 miles of the volcano, and found it about 50 feet in height, and two-thirds of a mile in length, still raging as before, and throwing up large quantities of stones, some of which fell a mile distant from the volcano. The smoke drew up several waterspouts, which, spreading in the air, fell in heavy rain, accompanied with vast quantities of fine black sand, that completely covered the *Sabrina's* decks, at the distance of 3 or 4 miles. On the 20th, they proceeded on a cruise, leaving the volcano about 150 feet high, and still raging, as formerly, and continuing to increase in size. On the 4th of July, they again visited it, and found that a complete island was formed, and perfectly quiet. The captain and several officers landed upon it, and found it very steep, and its height from 200 to 300 feet. It was with difficulty they were able to reach the top, which they at last effected, in a quarter where there was a gentle declivity; but the ground, or rather the ashes, composed of sulphureous matter, dross of iron, &c., was so very hot to their feet, that they were obliged to return. They, however, took possession of the islet in the name of his Britannic Majesty, and left an English union-jack flying on it.

The form was nearly circular, and the circumference of the isle at this time about a mile. In the middle was a large basin of boiling water, whence a stream, of about 6 yards across, ran into the sea, on the side facing St. Michael's; and, at the distance of 50 yards from the island, the water, although 30 fathoms deep, was too hot to hold the hand in. In short, the whole isle appeared as a crater; the cliff on the outside as walls, steep within and without; the basin of boiling water being the mouth, from which the smoke, &c., issued.

On the 17th of June, Captain Tillard, of the *Sabrina*, accompanied by Mr. Reid, the British consul, with two other gentlemen, proceeded overland to the cliff nearest to the volcano; and which was between 300 and 400 feet above the level of the sea. The first appearance it presented was that of an immense body of smoke revolving in the water almost horizontally, in varied involutions; when suddenly would shoot up a column of the blackest cinders, ashes, and stones, in form like a spire, and rising to windward at an angle of from 10° to 20° from a perpendicular line. This was rapidly succeeded by a second, third, and fourth, each having greater velocity, and overtopping the preceding one, till they had attained an altitude as much above the level of the eye on the cliff as the sea was below it. The columns of ashes, &c., at their greatest height, formed into branches resembling magnificent pines; and, as they fell, mixing with the festoons of white feathery smoke, at one time assumed the appearance of vast plumes of black and white ostrich feathers; at another, that of light wavy branches of a weeping willow. These bursts were accompanied by explosions of the most vivid lightning, with a noise like the continual firing of cannon and musketry intermixed; and, as the cloud of smoke rolled off to leeward, it drew up the waterspouts, above mentioned, which formed a beautiful and striking addition to the scene.

Subsequently the islet fell, by degrees, into the sea; and, in the middle of October, no part was left above water; but a dangerous shoal remained in the place which it had occupied. In February, 1812, smoke was discovered still issuing out of the sea near the spot.*

* About 15 leagues to the westward, a volcano, which had appeared in 1638, broke out from the sea in 1719, and disappeared in 1723. A depth of 80 fathoms was afterwards found on the spot which it had occupied. But see the description of Terceira for this volcanic shoal.

In June, 1841, Captain Vidal, in H.M.S. *Styx*, anchored in 16 fathoms, on the site of Sabrina Island, and found that the least water thereon was 15 fathoms.

St. Michael's contains one city, five principal towns, fifty-four parishes, and about, in 1840, 39,098 males and 41,711 females, total 80,809, living in 19,726 houses. The coast is very bold, and may be approached without fear in almost every part, the N.W. side excepted. Its military strength consists of 300 or 400 troops, with a militia of several thousand peasantry, whose arms are the pikes with which they drive their cattle. The principal fortification is the castle of St. Bras, which is close to the sea, and the western end of the city of Ponta del Gada. It is mounted with 24 pieces of cannon, but few of which are capable of service. A league to the eastward are two small three-gun forts, insufficient from decay and neglect. The island, notwithstanding, has many strong local holds; and several of the hills and passes, if judiciously fortified, would be impregnable.

The rich level country is properly adapted for wheat, Indian corn, and beans, or callivances. In the lava districts are cultivated the vine and orange, which yield most abundantly. It is generally understood that the lava, in the S.E. region of the island, is older, softer, and becomes fertile sooner, than that of the N.W., which retains such a degree of hardness as to be, in many parts, altogether incapable of yielding to human industry. In the intermediate parts, between the volcanic lands and the level country, the surface exhibits volcanic sand, metallic slag, pumice-stone, &c.

The landed rental is estimated (1851) at £160,000 a year: it exports 38,000 quarters of corn, one-half to Ireland, valued at £60,000; and 100,000 London size boxes of oranges to England (with the exception of about four cargoes sent to the United States), valued at £40,000. In 1801, the value of the fruit exported was £10,000, and in 1850 at about £65,000. In 1852 the orange crop is expected to amount to 150,000 boxes; value, £60,000. The number of vessels calling to trade annually is 250 British, 150 Portuguese, and 10 foreigners.

In 1851, it was stated (in the Nautical Magazine, August, p. 431), that there were nine exporting houses, four merchants, and five companies. Two extra companies have been formed on the North side of the island, where they had commenced building quays. An hotel and a few boarding-houses exist, and more would be built if invalids would choose to visit it in preference to Madeira, where boiling and cold springs do not exist, and the expenses are double. An English hospital for our sailors has been for the last few years supported by the shipping under the superintendence of our excellent consul, Mr. Hunt.

The City of Ponta del Gada is the chief seat of commerce, and contains 20,000 inhabitants. This town appears exceedingly pleasant from the offing, and derives an air of dignity from its numerous convents, &c. There is a mole for the protection of small vessels, but those of greater burden are compelled to ride in an open roadstead.* By deepening and enlarging the harbour, it might be rendered capable of receiving vessels of a considerable draught; and, by excavating the square of St. Francis, and cutting a canal between it and the mole, a large number of vessels might be accommodated. As it is, vessels of burden cannot safely use it; for they would risk the danger of slipping their cables, while loading or unloading, and, perhaps, not be able to recover their station for several weeks; or, at least, not dare to attempt its recovery during the prevalence of strong southerly gales.

The roadstead and harbour of Ponta del Gada are, however, the best that the island affords. The place of next consequence is that called Ribeira Grande, on the North

A beautiful print of the eruption of 1811 was subsequently published by Messrs. Boydell and Co. An earthquake may probably obliterate every indication of this phenomenon.

In Dr. Webster's late account of St. Michael's are some further particulars relative to the earthquakes, &c., in 1811, and it appears that the first appearance of a submarine volcano left a shoal to the westward of the spot on which the islet afterwards appeared.

* According to a notice issued by W. H. Reid, the British consul-general, November 10, 1816, a light was established on the top of the cathedral steeple in Ponta del Gada; a second on Ponta de Galera; a third in the S.W. quarter of the island; and a fourth was contemplated in the N.E. quarter. In October, 1818, Captain Livingston stated that there were two miserable lights at the first-named places. It has recently been stated that a light never existed at St. Michael's.

side of the island; but here is no anchorage; and, having no harbour, it is dependent for its commercial supplies on the towns on the South side. VILLA FRANCA, which is on the latter, has a very inferior anchorage, and that for small vessels only.

The COASTS of ST. MICHAEL, being bold all round, may be approached without fear, as there are no rocks or dangers more than a furlong from the shore, excepting some rocks at the N.W. end, and the volcanic shoal, already described. The former extend about half a mile from the Bay of Mosteiros, near the north-western point. The winds most prevalent, from October to April, are from S.W. to N.W., which frequently come in heavy squalls, particularly from the northward. In approaching from the eastward, Ponta da Galera, the southernmost point, should have a good offing, as the high land above it often occasions a calm, and there are some rocks off the point.

On approaching the N.W. end of the island from the westward, the appearance is very unpromising, as it presents barren mountains of stupendous bulk, with a coast like many ramified pillars of basalts, exhibiting, at top, a few trees of stinted growth. The impression made by a scene of rough and craggy cliffs is, however, soon dissipated by a pleasing contrast on the southern coast, as this presents a beautiful acclivity, adorned by luxuriant vegetation. Open pastures, bounded by woods, vineyards, and corn-fields, interspersed with orange and lemon trees, everywhere meet the eye, and afford a landscape, extensive and various, that will always, in clear weather, be seen with delight.*

The ROAD of PONTA DEL GADA, of which a particular plan is given on the Chart, has good holding-ground, on which ships may ride safely, excepting during gales from W.N.W. to S.S.E. The best marks are those shown on the Chart. Should a vessel be forced to quit the anchorage in winter, by a southerly gale, it will be best to round the western end of the island, and await a shift of wind from the N.W., which commonly succeeds a S.W. wind. Thus may the roadstead be easily regained; but, by running to the south-east ward, it may be ten days, or more, before you can beat back to the road. In beating up, keep close in shore, only avoiding some rocks, which lie near Ponta de Galera. The tide sets here, as shown in the Table. Fresh water is easily procured in the craft of the island.

In 1846, it was announced that the following signals had been established and shown from a flagstaff at the custom-house quay:—1. A *red flag*—vessels at anchor should immediately weigh, on account of the weather. 2. A *white flag*—vessels in sight may safely make for the anchorage. 3. *A red flag with white border*—vessels must not send their boats on shore, landing being dangerous.

It was also stated, that *four buoys* had been laid down in the anchorage, which would considerably reduce the risk of vessels leaving their anchors and chains behind them when they leave the roads.

Outline of the land over Ponta del Gada.

Those coming in on the northern side of the island, must be cautious of not getting embayed near Ribeira Grande, as there is no good anchorage on that side in case of a shift of wind.

* An excellent and detailed account of St. Michael's, its geological formation, its natural productions and general particulars, is given by H.M. consul, Mr. *Hunt*, in the Journal of the Royal Geographical Society, vol. xv., 1846, p. 268, *et seq.*

The ROAD of VILLA FRANCA is sheltered by the *Porto do Ilheo*, a remarkable volcanic rock, having a circular basin in its centre, with an entrance to it on the N.E., fronting the town of Villa Franca. The entrance of this basin has 7 feet of water, and is just broad enough to admit a small vessel. The basin is about 100 fathoms in breadth, and has had a depth of from 8 to 18 feet; the bottom of sand and small stones. This place is resorted to by small vessels for the purpose of careening, &c. It affords shelter from gales between West and South; but, as a part of the S.E. side is low, the wind from that direction throws a heavy swell into it, and renders it dangerous; and vessels caught with this wind must be scuttled, as the only way to save them. Not more than four vessels can lie with safety on the outside, in winter, under shelter of the rock on the N.E., where there are 4 and 5 fathoms of water. The ground near the town is foul and dangerous; but it is stated, that a ship may lie in 8 or 9 fathoms, between the town and islet, by fastening a hawser on shore.*

The Porto do Ilheo is a great natural curiosity; it having been originally a volcano of great height, whose apex has fallen into the caverns beneath, and forms the basin. Its appearance is extremely rugged and irregular. On its South side is a remarkable detached rock, distinguished by the name of the *Pyramid*.†

The breakers seen to the N.E. of St. Michael's will be found described in the next section.

Don Vincente Tofiño, in his description of St. Michael's, states that POINT FERRARIA, the westernmost point of the island, is high and sloped, but a low point projects from it into the sea, so as to form a rocky ridge to the S.W. At the distance of a league from land this ridge has over it from 7 to 10 fathoms of water, and a heavy sea rises over it, very high.‡ The little harbour of MOSTEIROS, to the N.E., serves for boats only. Of the islets here, the largest is high, sloped, and smooth at its summit, with an aperture, through which the sea passes from one side to the other.

NORTH SIDE OF THE ISLAND.—Between the Ponta (*Point*) dos Mosteiros and Ponta da Bretanha the land of the coast is high and rocky, and it forms the Bay of *Joam Bom;* at the bottom of which appears a very sharp-pointed mountain, called the *Pico de Maffa*, which serves as a very useful mark for ascertaining the coast.

Within the Ponta da Bretanha, and extending eastward, is the long village of Bretanha. The country here is highly cultivated, and pasture land.

The *Villa da Ribeira Grande*, already noticed, is rich, stored with all kinds of provisions, and abounds with good water, but landing is practicable only when the sea is very smooth.

PORT CAPELLAS.—The following description of this small harbour on the North side of St. Michael's is by Mr. *Hunt*, the British consul:—"Persons having stated that the bottom of the North side of St. Michael is foul in the anchoring depths, and that no vessel would be likely to recover her anchor if she brought up there, I thought it my duty to take the earliest opportunity of proceeding thither, with the agent for Lloyd's at this port, for the purpose of ascertaining the truth of these assertions.

"The result of our survey was, that at about half a mile distant from the shore, between Ribeira Grande and Capellas, there is a line, which, with occasional projections towards the land, separates the foul and stony bottom of the coast from a perfectly smooth and firm bed of fine sand, sloping to seaward; that, along this line, the depth varies from 25 to 35 fathoms; and that, from the rugged nature of the coast itself, the small port of Capellas

* There is a rock and reef lying S.W. by S., three-fourths of a mile off Point Aberfeira (which is 4½ miles East of Villa Franca). It is not volcanic, but has always been known. It is not on the early charts.

† In a letter to the editor, dated 28th of May, 1828, Captain Livingston says, "The *Ilheo* seems to be filling up with sand. The most of the rock is a kind of conglomerate of lava, in detached pieces, sand, debris, and pumice-stone, and on the East side it seems gradually wearing away. The highest part appears about 80 feet high. There are cultivated terraces on it, with cane-reeds, planted for shelter, and they grow not only potatoes and maize on it, but there are even a few poor vines, and some fine heath 3 to 4 feet in height.

"The singular volcanic *Peak of Camarinhas*, on the West end of the island, was the last active volcano in St. Michael's."

‡ There is a similar ridge, with islets on it, extending about a league from Point Matogoa, the N.W. point of the island: it has from 2 to 6 and 7 fathoms over it.

is the only part at which it would be safe for boats to disembark."* In a small plan, also by Mr. Hunt, the marks for anchoring are, first, the outer point of the port on with the Morro of Rio Grande, bearing E. by S.; and, second, *Point St. Antonio* on with *Point Minho.*

The N.E. POINT of the island is *Ponta da Reveira;* at more than 3 miles to the S. by W. [*S. by E.*] from this is the *Ponta del Arnel*, having a small port of the same name, but it is unsheltered, and the bottom rocky. The two points are of equal height, but between them is a slender bay, with sloped rocky land, in the middle of which is a very remarkable glen, wherein is a small river.

Of VILLA FRANCA, Tofiño says:—" It is situated on a beach, which forms but a very small bight. The channel between the islet (*Ilheo*) and coast is of the width of 3 cables' length, or thereabout, and is its principal anchorage; it has 10 and 11 fathoms of water, sandy bottom, and vessels moor North and South, with a hawser on shore, on the islet; but the latter, owing to its diminutive size, does not shelter a vessel from the wind and sea, between E.S.E. by South, to S.S.W. The town is capacious; and water, with all kinds of provisions, may be had here."

The distant view of St. Michael's is sometimes deceiving, in consequence of the haze which frequently covers the land; and the following observations will be useful in explaining any uncertainty which may be felt in making this island. Captain Midgley says:—" On the 26th of September, 1840, at daylight, I hauled up on a N.E. by E. course, by compass, to make *St. Michael's*, with a moderate S.S.E. breeze and fine clear weather. At noon saw the West end of the island bearing N.E. ½ E., and although the weather was apparently clear in every other part, a small portion of the land could only be seen, the remainder being covered with clouds and haze. The above bearing and observed latitude placed the ship 31 miles from the West end of the island. At three p.m. saw the eastern extremity of the land distinctly, but could not make out the land in the centre of the island; indeed, the haze which hung over it so completely deceived me for some time, that I considered TWO islands were in sight, and that I must have made some mistake in my observations: but, on drawing nearer to the land, as the sun approached the horizon, the fog dispersed, and I had a good sight of the centre of the island also. After sunset, the evening was fine, with serene clear weather. At eight p.m. the light of Ponta Ferraria was seen at 10 miles off—but such a light! had it not been marked on the Chart, I could not have believed it reflected from a lighthouse established for the direction of shipping—the light was really miserable; and, as it was not shown until long after every trace of daylight had disappeared (for the weather was quite clear, and a careful look-out kept for it), the light which was seen might have been reasonably supposed to be that of some fisherman or passing vessel. (It has since been stated that no lights are exhibited.)

"On December 31st, 1841, I intended to pass to the southward of St. Michael's, but a scant wind obliged me to bear up for the West end of that island, on passing which it had again the appearance of two separate islands, with well-defined extremities to each, the land in the centre being covered with fog and haze. When seen from the northward, on the following day, it had again the same appearance, that of two separate and apparently well-defined islands."

ISLE OF ST. MARY.—The preceding description of the appearances of St. Michael's will apply generally to St. Mary's, and the other islands. The town is on the South side, toward the West, on a bay, in which there is an islet; and between this island and the land is the anchorage, with a depth of 6 and 5 fathoms. For the position of the town and the chief points of the isle, see the Table.†

ST. MARY'S has a town and three villages, with about 4,500 inhabitants. Its chief productions are wheat and barley, of the first quality, with wine and cattle; but only sufficient for its own consumption. It has water in abundance, but of wood little, and a scanty proportion of fruit and vegetables.

"The Island of St. Mary is about 7 miles in its greatest, and 5 miles in its smallest,

* *Nautical Magazine*, 1842, p. 153.

† Immense quantities of molluscæ, or sea-worms, are certain signs of the proximity of St. Mary's. Some of them are of a white colour, or of arrow-root mixed with hot water, and are about 18 inches long, with orange spots on them, like the eyes of a peacock's tail.—*A. Livingston.*

diameter, and contains an area of 36 square miles, or about 27,000 English acres. It has nearly in the centre the double-peaked mountain of Pico Alto, 1,889 feet in height, which falls on the East and West sides to a shelving base of about a mile in breadth, and 850 feet above the sea. To the North and South it throws out a range of undulating heights, which terminate at the sea in lofty mural cliffs of more than 200 feet elevation. The East side of this range is covered with hills, diminishing in altitude as they recede from the centre, and intersected by numerous gorges of increasing width and depth, the channels by which the heavy rains of winter reach their points of discharge. The West side is a slightly inclining and undulating plain, also cut by ravines, terminating in cliffs more than 100 feet high. The aspect of St. Mary's is therefore on all sides perfectly bold; the central peak distinct; the subordinate range high and of varied outline; and the coast abrupt, precipitous, and based by the usual accompaniment of fallen masses.

"The surface on the West side is much overlaid with stones, and bears a spare vegetation of the grasses and weeds of argillaceous soils; the central range is covered with the common heath, myrtle, and arbutus of the Azores, and the East side is occupied, for the most part, with the agricultural produce of the island. Of trees there are a few in small plantations, and there is an increasing inclination to extend the culture of the orange; but the shrubs of the mountains, which contribute most to the wooded appearance of the surface, are fast disappearing under the axes of the fuel cutters, and the demand for land suited for the cultivation of corn.

"In its geology, St. Mary's is not like the other islands, where the surface of recent volcanic matter conceals whatever may have been their original constitution, or the progress of their growth. It is of trap formation, and contains in its beds of marine shells proofs of its elevation from the sea, but there are some points of similarity in its structure to that of St. Michael's; this is also the case with respect to Madeira, and still more to Sicily."*

"On the 31st December, 1841," says Captain *Midgley*, "at sunrise, with very clear weather, I made 'St. Mary's,' bearing E.N.E. by compass, distant 45 miles, at which time the land appeared from the deck to be like two small well-defined paps, rising out of the water close together; but on a nearer approach on the same bearing it appeared like a saddle land, which appearance it retained until the summits of some of the lower hills became visible."

Ponta de Castello, the S.E. point, is high, and has a break, which forms a peak, in the shape of a sentry-box. A vessel may anchor with this point S.W. by W. [*S. by W.*], and close to it in 10 fathoms, bottom of sand.

On the Eastern Coast, at 2½ miles N.N.E. [*N. 2° W.*] from Pta. de Castello, is the *Ponta dos Cedros*, which is likewise high; between these is a small point, off which is a low rock, at 3 or 4 cables' length from the coast, called *Baja da Malla*, but between it and the coast is a clear passage of 12 fathoms, in mid-channel, at half-flood.

At N. by W. [*N.W. by N.*] 4¾ miles from Pta. dos Cedros is *Ponta dos Matos:* between is the *Pta. de la Feitera*, with the Islet and Port of *San Lorenzo*. The point is high and remarkable, when near the coast: the islet is likewise high, and, on the eastern side of it, has a cave, into which the sea enters, and where a boat may be sheltered.

The Port of San Lorenzo is formed by the Islet and Ponta dos Matos, which are a full mile distant from each other. The bottom is sandy, and between the points is a depth of 10 fathoms, increasing gradually outward, but the depth of anchorage should not be less than 20 fathoms. Water may be readily obtained here, by making hollows, or small pits, in the sand on the beach, where the least excavation produces water of the best quality. There are several houses and a church close to the beach.

The Ponta das Lagoinas is the N.E. point of the island. The Islet Lagoinas, which lies off this point, is high, and sloped like a mitre; and, on being seen, in an East or West direction, exhibits a small level point, extending a little way into the sea. A rock, lying between the islet and land, obstructs the passage to large vessels.

The North Side of the island affords neither shelter nor anchorage; the whole of the western side is low and uniform.

* From a description of St. Mary's, by Mr. consul C. Hunt, in Journal of the Royal Geographical Society, vol. xv., 1845, p. 260, *et seq.*

The PORT and TOWN are situated, as already noticed, on the S.W. side of the island. The bottom here is sandy, and in some parts rocky, with from 10 to 4 fathoms of water. The rocky part is on the western side, and the eastern is the clearest. The Ponta da Marban is the easternmost point of the bay, and this, with the next point to the eastward, *Malbusca*, form a larger bay, divided into two parts by a black point, *Pedrera*. The coast hither, from Point Marban, is the most regular, and is called *Figueral;* on the top of it is a remarkable rugged mountain, but it is not so high as those on the North side of the island. Ponte de Malbusca is high, and stands at the distance of 2 miles to the westward of Ponta de Castello, the S.E. point of the island.

The ROAD OF ST. MARY is open, and exposed to southern gales. On this account it is resorted to, in summer, by small vessels only. In order to be ready for a start, it is proper to anchor to the S.E. of Marban Point, opposite Figueral, already described. The best anchorage, known to the pilots, is about a mile from the coast, in a line with Malbusca Point, and with the castle at the S.W. part of the town of St. Mary entirely open of Marban Point. Here is a depth of 36 fathoms, bottom of sand; but, at a short distance eastward, the ground is foul. Hence it is that Port San Lorenzo, on the N.E. side, is considered as the best anchorage about the island. At either place refreshments may be obtained, as at the other islands, with the addition of partridges, which abound here.

The FORMIGAS BANK AND ROCKS lie N.E., *true*, from the N.E., and nearest, point of Santa Maria, 19¾ miles distant.* It is formed by a submarine mountain of very irregular elevation, and which, traced to the depth of 200 fathoms, was found to extend 6¼ miles N.W. to S.E., by about 3 miles in greatest breadth.

Near its western margin there is a narrow cluster of black rocks, known as the Formigas, (or *Ants*), which are about 800 yards in length by 150 in extreme breadth, their relative direction being N. 25° E. and S. 25° W., or *North* and *South*, *true*. The southernmost of them, for about 350 yards, forms rather a closely connected mass, having a small bay on the West. The northern ones are more separated from each other, and all are of comparatively little elevation, but the profile exhibits a few hummocks. That on the southern extremity, which is 27 feet above low-water springs, afforded a theodolite station for the survey, and is in lat. 37° 16′ 14″ N., lon. 27° 47′ 6″ W. Variation, August 17th and 18th, 1843, 25° 17′ W.

The most elevated rock of the group, named *Hormigon*, by Tofiño, is 35 feet in height, and stands on the eastern side, about 200 yards from the northernmost rock, and somewhat more isolated than the others, and having an inclination to the southward.

With smooth water there is no difficulty in landing, particularly on the southern rocks; but in strong winds or a high swell the sea rolls over them all, leaving a black naked surface entirely devoid of vegetation. At 130 yards South of the southern Formiga is another small rocky shoal patch, visible at low water, the channel between having 5 to 15 fathoms. Again, 600 yards South of the South Formiga is another small rocky patch, having 4½ fathoms on it at low water. It is steep-to on all sides but the North, where it is connected with the rest by irregular depths of 8 to 14 fathoms.

On the North the Formigas may be approached within a few yards, but a narrow ridge runs out 400 yards with varying depths, but no danger. It has 18 fathoms on its outer end, and immediately drops on to 30 and 50 fathoms. On the East and West the Formigas are quite clear, with deep water close up to them; on the West the bank extends half a mile, but all very deep water.†

* Captain A. T. E. Vidal, who has surveyed these islands, says, with respect to Tofiño's representations of the Formigas:—"It is with regret and vexation I have to state, that I find Tofiño considerably in error, in that celebrated hydrographer's work relative to this locality. The true bearings of Punto Castello, as ascertained by Captain Vidal, differ from those of Tofiño 4° 35′ more westerly, and Pico Alto 6° 08′ more westerly. This difference in bearing is on a distance of 22 miles. Although my observations on board the vessel with sextants perfectly confirmed the true bearing obtained with the theodolite, I was unwilling to think Tofiño could be in error. I therefore landed again the next afternoon a little later, to have a lower altitude, and that second day's result was Punta Castello S. 29° 2′ W., and Pico Alto S. 40° 36′ W.; Tofiño or his people are therefore in error." This correction will place the danger about 3′ of longitude to the eastward of its assumed position, and in the same latitude.

† Account of the Formigas Bank, by Captain Alex. Vidal, R.N., Journal of the Royal Geographical Society, vol. xix., 1848, p. 160.

Tofiño thus describes them:—"The FORMIGAS are some rocks which navigators have considered as extremely dangerous, imagining a great part of the space hereabout to be strewed with sunken rocks, and therefore to be avoided; but, having examined these dangers, it is proved that the whole of them are visible, concentrated, and clear, and that vessels of any burden may steer for them, in order to pass on the North or South side, as may be most convenient."

Other rocks also exist, as shown in the next paragraph, at the distance from them of about 3½ miles to the north-eastward. We derive our knowledge of the latter through the favour of Captain Livingston.

DOLLABARATS' SHOAL.—*To the S.S.E. of the Formiga* there is a danger, which was shown on a Chart of the Atlantic Ocean, 1766, but afterward omitted in other charts, from want of positive information as to its existence. This shoal was seen by *P. Dollabarats*, commander of the ship *La Marie de Seboure*, in 1788, on his return from Martinique to Bayonne. On the 7th of March, at 3 p.m., when about to double the Formigas, at the distance of three-quarters of a league, he descried a breaker to the S.E. of his ship, which appeared to extend a league *true North and South*. He observed, that it lies *S.E.* 5° *S.* (*true*), at the distance of 1½ leagues from the Formigas.

A new and very beautiful brig, the *Zillah*, Martin, of Dundee, bound to Hayti, struck on a sunken rock "off the Formigas," at 10 o'clock, in the night of the 9th of April, 1832, and was abandoned at 3 p.m. of the next day, having then 7 feet of water in the hold. About midnight she was seen to go down. Crew picked up and saved by the *Morley*, of London.

Captain J. D. Markland, of H.M.S. *Briton*, in a letter, dated 20th February, 1832, writes:—"I hove-to for the night between St. Michael's and St. Mary's, being anxious to see the Formigas Rocks; and soon after daylight, with a thick morning, we fell in with a very dangerous shoal breaking heavily, and, as the fog cleared away, we saw the Formigas. When the rocks and the shoal were in one, the shoal bore from the rocks S.S.E. about 3 miles. This must be the *Dollabarats' Shoal*. The Formigas are properly placed."

In confirmation of this statement, the following appeared in the *Shipping Gazette:—Notice to Mariners.*—Lisbon, Dec. 6th, 1843. A notice has been issued by the Minister of Marine, to the effect that a shoal, with 11½ feet of water on it, has been discovered about 4 miles to the south-eastward of the "Formigas," or Great Formiga Rock, in the vicinity of the Azore Islands.

Captain Vidal has set the question at rest, and has accurately fixed its position. "Dollabarats' Shoal bears (*S.* 44° *E.*), *true*, from the Formigas, distant 3½ miles, and is in lat. 37° 13′ 30″ N. We anchored close to it, and scoured the ground with our boats. It is a fearful danger: the least depth we found on it was 11 feet at low water. "It consists of two or three rocky heads or knolls, which, at low-water springs, have only 11 feet water on them. At that time of tide their position is marked by several large white patches, which may be distinctly seen, especially so in bright sunny weather. The shoal is near the southern edge of a rocky ridge, which extends from it N. 15½° E. 1$\frac{6}{10}$ miles. The soundings over it are most irregular, varying from 14 to 50 fathoms at its edges, but there are no other actual dangers on it. The Dollabarats' Shoal is a very insidious danger in smooth water, but in stormy weather the sea breaks over it with great violence."—(*Captain Vidal, R.N.*)

TULLOCH REEF.—In 1808, Captain William Tulloch, of the brig *Equator*, of Portsmouth, New Hampshire, on a voyage from Madeira to St. Michael's, was alarmed by some of his crew seeing breakers. After altering his course, he still saw breakers ahead, and as it blew too hard to be able to haul by the wind, and weather them, he determined, as his only chance, to endeavour to push through among them: accordingly, having taken in every sail, excepting the fore-topsail, he went to the fore-topmast head himself, and conned his vessel safely through, by luffing up and keeping away, as he saw necessary. Captain Tulloch counted distinctly twenty-one heads of rocks, none of which appeared to have much water over them, and two of the rocks show occasionally above water, in the wash of the sea. Their extent, the captain thinks, did not exceed half a mile from North to South, and was still less from East to West. They bore E.N.E. by compass from the highest rock of the Formigas, then in sight, distant about 10 miles, and appeared very black below water.

The breakers on the Tulloch Rocks have been stated to have been several times seen since 1808: among others, by the *Ayrshire*, bound from the Clyde to Demerary. Mr. Ferguson, the mate of that ship, gives their situation as about *nine* miles E.N.E., by compass, from the Formigas.

Captain J. Henderson, commanding the ship *Fortescue*, from Mauritius to London, saw the Tulloch Rocks on the 17th April, 1829. Breakers were observed for half a mile East and West. The Greater Formiga and breakers in one bore W.S.W. (by compass), the former about 4 leagues, and the latter 2 miles distant. There appeared to be several heads near the surface of the water. A westerly wind, and a heavy ground swell, prevented sounding.

Notwithstanding all that has been asserted as to the existence of this reef, it was not found by Captain Wilkes in 1838, as the following extract from his work will show:—"On the night of the 13th September we laid by, just after passing the North end of St. Michael's, in order to examine the position of the Tulloch Reef by daylight. We passed within 1½ miles of its reported position, but saw nothing of it, although the sea was running sufficiently high to have made a heavy break on it, if it did exist."*

Capt. Vidal, R.N., in order to set the question of its existence in some better light, sought minutely for it. In the first instance, the steamer was started E.N.E. from the Formigas, and carried out 14½ miles in that direction, sounding, at frequent intervals, with 200 fathoms, without reaching the bottom. She returned, traversing *across* this bearing. On three subsequent trials, with all caution and look-out, no signs of shoal water or soundings were obtained. "We must express our opinion," says Capt. Vidal, "upon this reputed danger, as formerly upon the apparently well-authenticated statements relative to the Aitkin Rock. It looks very like a whale, but, seeing the difficulty there is in discovering small rocks beneath the surface of the ocean, we by no means presume to assert that Tulloch Reef does *not* exist, but we entertain a very decided opinion that it will not be found in the position which has been assigned to it." It is again noticed hereafter, among the shoals of this part of the ocean.

A *dangerous shoal* has been reported to exist between St. Michael's and Terceira. seen at the latter end of 1848. These notices were transmitted by H.M. consul, T. C. Hunt, Esq., to Lloyd's. In substance they are as follow:—Benjamin Pratt, of the *William*, on December 31, 1848, saw breakers, mast high, evidently caused by a shoal, and not by a floating mass. The observations then taken place it in lat. 38° 16′ N., and lon. 26° 41′ W. The next is the declaration of Victorino Falcao, of the *Tres Amigos*:—On December 31, 1848, saw a shoal where the sea broke the height of a ship, at intervals of about ten minutes. By calculation it is in lat. 38° 18′ N., and lon. 26° 50′ W. The third is the declaration of George Perkins, of the *Plymouth*:—On December 25, 1848, I saw the sea breaking heavy at the distance of 2½ or 3 miles to N.N.W. A heavy sea was running, and the water broke 60 feet high in different places, at intervals of about ten minutes, as if on an extended shoal, having several heads. It was certainly not a floating obstruction; I consider it a narrow reef, about a mile in length, running from N.N.E. to S.S.W., about 40 miles W.N.W. ½ W. (by compass?) from the N.W. point of St. Michael's.†

A notice to mariners was issued by the Trinity House, warning them of this danger, as announced by the three statements above.

TERCEIRA.—This island is fertile, pleasant, and healthy; the lava districts here, as at St. Michael's, produce excellent vines, although not equal to those of the Canaries and Madeira. The land yields large crops of wheat and other grain, pasture for cattle, and a prodigious quantity of lemons, oranges, and all those fruits of hot and cold climates which are propagated to the greatest advantage in temperate countries. The capital, as already noticed, is ANGRA, on the South side of the island, having a harbour, defended by a fortress, in which resides the governor of the Azores. Angra is distinguished by several handsome churches, convents, &c. Besides this, there is another town, *Praya*, and fifteen villages, all of which contain about 30,000 inhabitants. In the bay of Angra, and around the island, fish, of a good quality, is abundant.

* "Narrative of the U. S. Exploring Expedition, during the years 1838-39-40-41-42, by Charles Wilkes, U.S.N. Commander of the Expedition, Member of the American Philosophical Society," in 5 vols., and an Atlas. London: Wiley and Putnam, 1845, vol. i. pp. 5, 6.

† Shipping Gazette, March, 1849.

The coasts are high, and so surrounded with craggy rocks, as to render the island almost impregnable; every accessible part being defended by batteries, with heavy cannon, and a numerous garrison. The interior is, in general, moderately high, but the western side is higher than the eastern, and is distinguished by a rugged mountain, extending nearly East and West, and of which the western extremity, *Pico de la Serreta*, is the most elevated. This peak may be known by a great break on the eastern side, at a short distance.

DESCRIPTIONS, &c.—The part of the island* in which Praya is situated, is the most fertile of the whole; on which account it was the part selected by the first discoverers for their residence, and its population was entirely agricultural. It is the part from which levies were principally made to resist the landing of an expedition in favour of Don Miguel, in August, 1829; when a small military force, with their assistance, and the possession of the strong forts on the Bay of Praya, beat off the much superior force of Don Miguel.

The town of Praya had, in the year 1614, been totally destroyed by an earthquake, which considerably injured the town of Angra, and was severely felt in the Island of St. Michael. Since that time it had escaped injury, although menaced by many severe shocks of earthquakes.

On the 12th of June, 1841, at 4 p.m., a violent shock of earthquake was felt at Praya, extending with diminished violence to the westward. At $5^h\ 25'$, a second and more violent one was felt; the trembling continued throughout the 13th, and on the 14th an undulation destroyed all the buildings which had been weakened by the former shocks. The inhabitants of Praya then retreated to the fields for safety. During the 14th the motions were slight; but on the 15th, at 3 a.m., a violent trembling and horizontal undulation commenced, and continued, with intervals of about ten minutes, until $3^h\ 30'$ a.m., when a strong vibratory and distinctly visible rocking motion of the surface threw down the entire town of Praya, and injured many other parts of the island. The ground remained comparatively quiet until $2^h\ 40'$ a.m. of the 16th, when another violent shock did further damage. After this no further damage was done, but the island did not become perfectly quiescent until the 26th of June.

It was observed, with respect to the whole progress of these phenomena, that the motion was greatest at Praya, where a rent has been left in the ground of about an English mile in length, from the edge of the water stretching westward; and that every convulsion was preceded by a loud subterraneous noise, resembling thunder, so exactly varying in intensity according to the severity of the succeeding shocks of earthquake, that the first became the harbinger and gauge of the other.

The number of houses destroyed was estimated at 800, besides other considerable damage, amounting to the value of £180,000.

The less severe shocks did not extend beyond the Island of Terceira, others were experienced of apparently equal force at St. George and Graciosa, and only that which destroyed Praya was felt (but not severely) at the capitals of Pico and St. Michael's. At Fayal, and at the eastern end of St. Michael's, no motion was perceived.

It is therefore probable, that the origin of this earthquake was a submarine volcanic eruption, and that its position or centre was about 17 *miles due East from the eastern end of Terceira*.† This brings us to another subject, that of the volcanoes that have been seen to the eastward of Terceira.

VOLCANO BETWEEN TERCEIRA AND ST. MICHAEL'S.—It is stated that, in 1719, a volcano appeared at 15 leagues to the westward (query, north-west) of St. Michael's, and disappeared in 1723, and was supposed to occupy the situation of that which had appeared in 1638. It is also stated, that in 1720 an island appeared at the S.W. extreme of St. Michael's, about a mile from shore; this, perhaps, is connected with the other statement, but is not very circumstantial. But we have the following accounts of this occurrence: Mons. Ségur Dupreyon has found some documents relating to it in the French colonial

* The following account of the island, and the great earthquake of 1841, we have taken from a communication, by Mr. T. C. Hunt, the British consul at St. Michael's, to the *Nautical Magazine*, September, 1841, pp. 631—633.

† This proposition has been ingeniously argued out by Mr. Hunt, from the various degrees of intensity that the shocks were felt in the different bearings and distances; by arranging these together, it fixes the centre of the action as above.

archives; the first states that at the end of 1720, a volcano broke out at 28 leagues off St. Michael's, towards Terceira, which formed two shoals. A second statement affirms, that it ejected large quantities of pumice. A plan was also forwarded to France of the new island, though it could not be approached, in consequence of the jets of boiling water which were thrown upwards of 120 feet high. The consul announced that, on July the 7th, 1722, this new island had sunk down, and could only be distinguished by breakers.*

In the "Philosophical Transactions" is a much more complete account of this volcano. It is dated May 12th, 1722. In that communication, it is described as lying 17 leagues S.E. from Terceira. "The fire broke out on November 20th, 1720, in the night, and the prodigious noise it made caused an earthquake, which shattered down many houses in the town of Angra and places adjacent, to the great terror of the inhabitants." The governor went with John Robinson, master of the *Richard and Elizabeth*, a small pink snow, who had passed the volcano on December 10th. "On Sunday, December 18th, we got under sail, and stood from Angra south-east. The next day, at 2 o'clock in the afternoon, we made an island all fire and smoke; we continued our course till the ashes fell on our deck like hail or snow all night. We bore from it, the smoke and fire roared like thunder or great guns." "Prodigious quantities of pumice-stone, and half-broiled fish, were found floating on the sea for many leagues round the island, and abundance of sea birds hovering about it." "An acquaintance of mine informed me, that in his passage from Cadiz to London, the latter end of April was twelve months, he observed the sea from Cape Finisterre, almost to the chops of the Channel, to be covered with pumice-stones, some of which he gave me."

"This island is almost round, and supposed to be about 2 leagues in diameter. By good observation, it is 38° 20′; its lon. 26° 33′.†

We shall now revert to Mr. Hunt's observations on the earthquake of 1841. "It is by no means a great stretch of hypothesis to suppose that the late earthquake has, like some former ones, been accompanied by the ejection of submarine volcanic matter, which may have been thrown up within a short distance of the surface; so that, in fact, in that part of the sea where there was previously 200 fathoms of water, there may at this moment exist a most dangerous shoal.

"As in navigation the extreme of safety should always be chosen, the commanders of vessels approaching Terceira would do well to keep a good look-out, and be prepared for indications of shoal water, at from 15 to 20 miles to the eastward of it." The most recent occurrence here, that we have met with, is, without doubt, connected with the same volcanic centre. It is in the *Nautical Magazine*, July, 1843, p. 482, entitled "*Malabar Bank.*" Extract of a letter from Capt. Sartorius:—"In lat. 38° 57′ from the observations at noon, and lon. 26° 4′ by chronometer, and from supposed most correct bearing of the land, the north-east end of Terceira, taken at 8 a.m., gives lat. 38° 57′, lon. 20° 57′, the ship grazed over, apparently, a shoal of about her own length. There was no sudden shock, no appearance of discoloured water, or any other indication of the vicinity of rocks or shoals; and at the time the motion was felt the ship was going 8 knots, wind aft, and studding-sails set.

"I immediately shortened sail, and sounded with 180 fathoms; no bottom. There was too much swell to risk a boat for examination. My own individual opinion is, that it is as likely to have been the shock of an earthquake as passing over a shoal."

This spot will be about 30 miles to the north-east of the reported situation of the submarine volcano above described, and if the reader will turn to the Ethiopic Memoir, 1844, p. 80, he will find that a submarine shock and grounding on a shoal give precisely the same sensations in a ship. That this was a shock that Captain Sartorius felt, there can be but very little doubt, and it is most probable from the same volcano. We must, therefore, recommend to the seaman's notice the cautions of Mr. Hunt, as given above.

The position of the city of Angra is shown in the Table.

* Comptes Rendûs de l'Academie Française, 1838, p. 302.

† "Part of a Letter from T. Forster, Esq., F.R.S., to Mr. Machin, Sec. R.S." Phil. Trans., 1722. To this description are attached several views of the island, which were taken at the time.

At the town provisions are cheap, and in plenty. The bay may be readily known by means of a remarkable forked hill, near the sea, on the West side, named *Mount Brasil*,* and by two steep little islets, called the *Cabras*, or *Goats*, which lie about 4 miles to the eastward of the mount. About 2 miles to the south-eastward of these islets is another, called *Los Frayles*, with breakers near it.

In approaching from the S.W., South, or S.E., steer directly for Mount Brasil. Should the wind be adverse, when approaching the land, tack boldly without the bay, as there is a sufficient depth over it, and up to the shore.

But beware of a calm, as the currents are very strong and variable. If you have not a leading wind, when sailing up toward the mount, avoid too near an approach to the coast, between it and the westernmost part of the island; as it would, in a calm be attended with the utmost danger; the coast being iron-bound, a ship driven on it would be in a most perilous situation.

ANGRA.—The Bay of Angra is open to all winds from S.S.W. by the South to the East. The swell from the S.W., in particular, which sets round Mount Brasil, on the western side of the bay, is tremendous. The ground, at the entrance, is foul, and ships should always moor to the northward of Fort St. Antonio, which is on the West side of the bay.

The tides rise as shown in the Table, p. 149. The flood sets in to the N.W.

Vessels may safely remain in the road in June, July, August, and September, when the winds are light, and prevail from between West and N.W. But, on the commencement of winter, the winds from the offing rage so violently, that, upon the least appearance of bad weather, it is requisite to put off to sea, the coast affording no shelter.

PRAYA BAY, or Port Praya, on the eastern side of Terceira, has been described as the largest and safest bay in the Azores. "This bay," says M. Fleurieu, "has the form of a crescent: the point toward the North has, at its extremity, a small islet to the N.E. To lie in the best place, this islet must shut in with the point, and the two towers seen on the bottom of the bay must be brought together: you will be then in 24 fathoms, sandy ground, the town bearing N.N.W. and North. You may also anchor nearer to the shore, in 20 and 16 fathoms. The boats must not attempt to land at the bottom of the bay toward the S.W., on account of a sand-bank, upon which they would ground; but they will find a good landing-place near the castle."

The following is a more particular detail of the Coasts of Terceira, abridged from Tofiño.

The *Mount of Brasil*, near Angra, is moderately high, and has two small columns, or pillars, at the top, which serve as look-out places. The hill descends gently toward the North, and at its base, on that side, is the *Citadel or Fort of S. Juan*, the chief defence of the island, and particularly of the city of Angra, which stands to the northward and N.E. of it. From the citadel, a line of wall and batteries extend to *Fort S. Antonio*, on the East side of Mount Brasil; the opposite, or N.E. side of the bay, is defended by *Fort S. Sebastian.*

Merchant vessels regularly anchor in the line of the forts S. Antonio and S. Sebastian, or rather farther in, mooring with the four anchors. This is necessary, the bay being open to the sea from S.S.W. by South to East, and therefore extremely unsafe when winds from those quarters may be expected, the coast being mostly of sharp rocks. Large ships anchor to the eastward of Mount Brasil, in from 30 to 40 fathoms of water, sandy bottom, and they must be ready to get under way in the instant that the wind appears to be coming on from the south-eastward or south-westward.

On the western side of the castle of S. Sebastian is a little beach, slightly sheltered by a wall of the castle. It is called *Puerto de Pipas*, and is the spot wherein fishing-vessels are secured, by grounding them on the sand. It may serve as a landing-place when the sea will not allow you to land at the mole.†

The boats of the island come out so soon as any vessel is seen to anchor, and by them supplies may easily be obtained, even while keeping under way, tacking in and out, as they will bring water, wood, and all kinds of provisions.

* See the particular plan of the Road of Angra, on the Chart.

† It is sometimes much easier to land on the rocks under the cliff, on the Mount Brasil side of the bay, than at Puerta da Pipas. A footpath, of difficult ascent, marks the proper spot to attempt landing at.—*A. L.*

The *Ponta de las Contiendas* is the S.E. point of the island. It presents an eminence, having three peaks on its summit. At about halfway between this and Angra are the *Cabras* or *Goats*, already noticed, which lie S.E. by E. [*E. by S.*] 4 miles from the summit of Mount Brasil, and two-thirds of a mile from the nearest part of the coast. Of the two islets, the eastern is the largest and highest: when seen from the East or West, it appears like a wedge. Between the islets is a channel for row-boats, with from 8 to 10 fathoms of water: between them and the coast a ship may pass, as there are 9, 12, and 13 fathoms of water, with sandy bottom, and rocks near shore only.

The *Frayles*, or Friar's Isle, before mentioned, is a low islet, having two pyramidal peaks. A shoal extends from the S.E. side of it, about a cable's length, over which the sea breaks. Several cliffs on the islet give it the appearance, at a distance, of several isles. A ship may pass, with all safety, in the channel between this and the Cabras, the depths being from 60 to 75 fathoms, gravelly bottom, and clear ground.

The eastern coast of Terceira is generally broken, rocky, and dangerous. The easternmost point is that named *Malmeranda*, which is high and oblique, with a large shoal near to it, which shows itself at low water. To the south-westward of this point is the town of PRAYA, defended by batteries. The bay on which this town is situate is of great depth, with good holding-ground, and a fleet may anchor here, sheltered from the South, by the West, round to North, but entirely exposed to the eastward: the safest anchorage, therefore, is with Point Malmeranda in a line with the northern islet, Cameiros, and the highest tower or steeple of the town, which is the northernmost, open to the West. Here is a depth of 25 fathoms, with sandy bottom; and, as at Angra, supplies may be obtained from the boats of the place.

REMARKS ON TERCEIRA, *by Captain Livingston*, 1822.—"At about 6½ or 7 miles North of Angra, in a valley near the summit of the mountains, a great deal of steam issues from crevices of the earth, or rather clay, which clay, I am informed by a scientific gentleman here, is actually lava, decomposed by the action of sulphuric acid. Some of the clay looks, when cut by a knife, much like Castile soap: it is of various hues, and the natives of Terceira use it as paint. There are small quantities of sulphur formed around some of the apertures. The steam which rises is very hot: we cooked some eggs by laying them among the clay, at mere cracks whence steam issued. My thermometer ranged only to 152° of Fahrenheit's scale. I exposed it to the steam at the first aperture I reached, but the mercury rose so rapidly, that, from fear of bursting the tube, I was obliged to withdraw it, I think, about three or four seconds. Persons visiting Angra, who have any curiosity in their composition, should see this *furnaso* or *souffriere*. The access to it is by no means very difficult, though, if you ask any of the Portuguese, they will describe it as accessible only at some periods of the year. One may ride to within less than half a mile of it. Ponies, or asses, and guides, may readily be hired.

"The CITY of Angra is generally very regular, the situation beautiful, and the streets have excellent regularly flagged footpaths. The houses are commonly of three stories. Mount Brasil, on the land side, seems strong; and Fort St. Sebastian, on the Puerta Pipas side of the bay, is a small but strong fort. These fortifications were erected by the Spaniards when they were in possession of the island.

"Some vessels, mistaking Praya for Angra, have stupidly run in there; but the Goats and Mount Brasil are sufficient to show the most entire stranger the difference: I annex a sketch of the former.

The GOAT ROCKS, *as sketched at nine a.m., 25th, January, 1822, when about 2 miles distant, the weather being hazy, and the tops of the mountains of Terceira covered with dense masses of clouds. Point at the ⁎ bearing N. by E. by compass, and that at ⁎⁎ N.E. ½ N. also by compass.*

"No vessels should go to Angra without two good chain cables; the bottom in the bay being generally too foul for any trust in hempen cables.

"The better sort of people in Angra (natives) are very hospitable and kind, but full of ceremony. The poor people are generally very clean, and none seem in want of the necessaries of life. None of that wretchedness which we so often see in this country is visible; but many of the older peasants have their clothes, though clean, so industriously patched, that it is next to, or altogether, impossible even to conjecture of what colour they originally were.

"There are some fine pine-woods in the island; a good deal of box-wood, and some cedar. Plenty of juniper, the berries of which are so very strong, as to leave, for a long time, a very unpleasant flavour in the mouth after chewing them. There is plenty of pumice-stone, but of a coarse quality, in the island, and everywhere marks of volcanic agency are apparent. Water is good, but it is not so easily procured as might be supposed.

"The Terceira fruit (oranges) has improved much of late years, more attention having been paid to its culture; and it is now little, if at all, inferior to the St. Michael's.

"Very good linen is made in the island, and they manufacture a coarse earthenware, the clay of which it is made being imported from St. Mary's. No noxious animal is known; nor, though there are many dogs, has hydrophobia ever made its appearance. The natives rear a great many swine, most of which are remarkably broad backed. Their backs are generally shaven, which, it is alleged, allows them to spread in fattening.

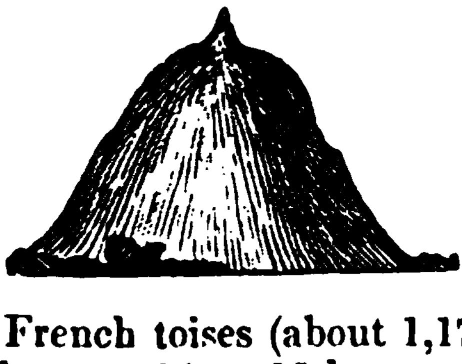
"Bloody flux is very frequent both among strangers and natives, and is often fatal. A Scottish surgeon there told me, it was the worst disease he met in the island.*

"Vegetables are excellent and cheap. Poultry and eggs good and reasonable; beef and mutton tolerable, the former about threepence per pound. Some of the island wine is tolerably good.

"I was surprised to see a pretty fair bunch of bananas one day carried by a peasant. They have apples, pears, figs, chestnuts, and walnuts, and, I have heard, some olives, with abundance of grapes. Gooseberries and currants, I am told, have been tried, but have not succeeded. They have a very fine tough willow, which makes excellent hoops and baskets; also plenty of yams, Indian corn, wheat, and excellent barley, also tolerable potatoes. The market is generally well supplied with good and cheap fish. Rabbits and quails are plentiful; thousands of blackbirds, fine turkeys; few or no geese; no peacocks, and no pheasants; a few red-legged partridges; and I have heard it positively asserted, that there are some grouse on the mountains, yet I doubt the fact. There is a good deal of orchilla weed, which is of a grayish colour, sometimes slightly tinged with a reddish hue, and famous for producing the violet or crimson dye. It is monopolized by the government."

The North Coast of Terceira should not be approached by a stranger, as it is rocky and dangerous. The western coast is also inaccessible. Near the S.W. point is the Pico de Santa Barbara, a small but remarkable mountain, with a vigia, or look-out, on its summit.

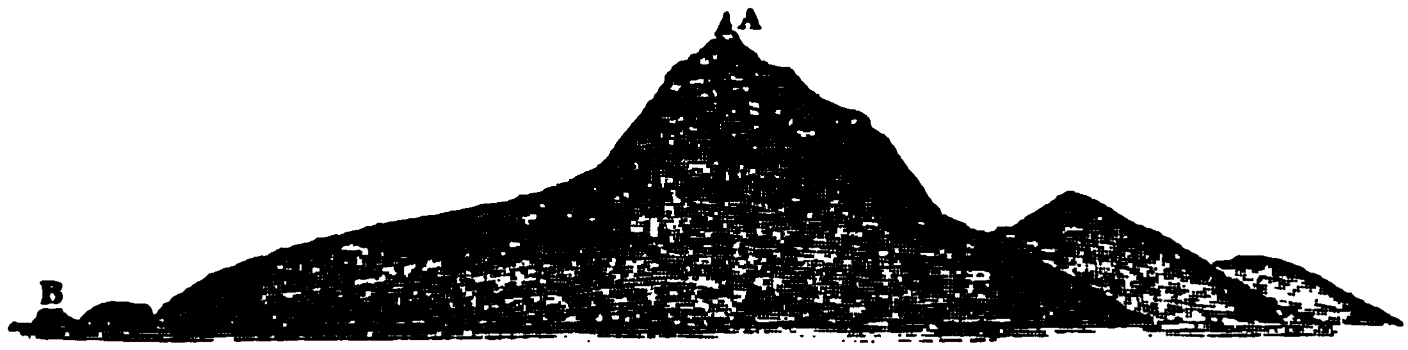
PICO.—This island derives its name from the remarkable peak or volcanic mountain which stands upon it, and which appears, when seen over the southern coast of Fayal, nearly in the form represented on the margin. The summit of this mountain, whose sides are neither very steep nor uneven, is terminated by a small sugar-loaf, so very regular, that one would think it had been made by art. The height of the peak, above the level of the sea, according to the geometrical operations of the French astronomers, is 1,100 French toises (about 1,172 English fathoms); and, consequently, in clear weather, it can be seen 24 or 25 leagues off; but it is frequently so obscured by clouds, as not to be seen



* It deserves to be known, that the size of a hazel-nut of Castile soap, scraped fine and dissolved in about three wine-glasses of boiling water, to which add half a wine-glass of good spirits, and a few lumps of white sugar, scarcely ever fails of curing bloody flux. Two or three doses may be required. I have tried it on myself and others with perfect success.—*A. L.*

at any distance.* When the southernmost point of Fayal is in a line with the peak, E. by S., this mount appears as shown before.

The peak has been described as filled with dark volcanic caverns, which have frequently emitted smoke, flames, and ashes, to a considerable distance. At the foot of the mountain, toward the East, is a spring of fresh water, generally cold, but sometimes so heated with the subterraneous fire, as to rush forth in torrents, in a boiling state, and sending forth a stream of sulphureous vapours, vitrified stones, &c.



Pico, *when the Peak* (A) *bears E.S.E. by compass.*——(B) *E. by S.*

PICO contains about 22,000 inhabitants, who occupy three towns and eleven villages. The soil being stony, little grain is produced, and the greater part of the wheat and maize, for consumption, is imported from the neighbouring islands. The wine is the staple commodity, and is reputed the best in the Azores. This, with brandy, is exported in considerable quantities. The cattle are various, numerous, and excellent; fruit is abundant, and equally fine. Besides these, they have cedar and other timber, including a beautiful kind of yew, called *Teixo*, which is remarkably solid and fine; but which is monopolized by, and felled only by order of, the government.

The *vinto tinto* of Pico, made from the Oporto vine, propagated in Pico, Captain Livingston thinks excellent; but it is not plentiful. The teixo wood, he says, is the same as our yew.

For the position of Pico, see the Table, page 51. The principal towns and villages are Lagens, Pico, Santa Cruz, St. Sebastian, Pesquin, S. Rocca, La Playa, and Magdalena.

The S.E. point of the island, which is rather low and sloping, is named *Ponta de la Isla;* a ridge extends from it to the eastward, 1 cable's length. The next projection, on the South coast, is *Pta. de Caleta*, or Nesquin, distant 5 miles, W. ¾ S., *true;* between are the little harbours *Muelle de Manana* and *Nesquin*, fit only for coasters, which may ground on the sand, the bottom being generally rocky. At N.W. by W. [*W. by N.*] 6¾ miles from the Pta. de Caleta is the *Pta. Arrife*, which is rather more elevated: the coast between continues rocky, and is not to be approached by strangers. Eight miles N.W. by W. [*W. by N.*] from Pta. de Arrife, is that of Santa Catalina; the coast between forms a slender bay, in which, at 2½ miles from the former, are the town and lagoon of LAGENS; the latter communicates with the sea by means of a bar, over which the coasters pass at high water. The fishermen have another place of shelter, in *Puerto Praima*, which is on the N.E. of the point Sta. Catalina.

On the S.W. and West sides of the island is nothing remarkable, but its rocky coast and islets. From the Pta. de los Baxios, on the N.W. side, breakers extend outward, to the distance of nearly a league, during a gale.

Off the most prominent part of the western coast are the little Port and Isle of La Magdalena. From the town, which stands here, the greater part of the produce of the island, for exportation, is shipped off for Fayal in small row-boats. The islets are surrounded by rocks; but very near the latter the depths are 6, 7, and 8 fathoms, rocky ground.

* The Spanish surveyors have since given the height of the peak, from its observed altitude, above the level of the sea, as 1,212½ Spanish toises (1,103 English fathoms only). The mountain, they observe, covers the whole of the western part of the island; its skirts, and even halfway up, are covered with vines; the next fourth part by shrubs; and the last and highest part seems all of rock, covered with a very short grass. An ascent to the summit may be made, though not without difficulty, and some caverns afford occasional shelter.

Upon the supposition that the height last mentioned is correct, when the summit of the peak appears at 1° above the horizon, its distance will be 50¾ miles; at 2°, nearly 32 miles; at 3½°, 19¾ miles; at 5°, more than 14 miles; at 6½°, nearly 11 miles; at 8°, nearly 9 miles; *and at 10°, nearly* 7½ miles.

The North coast, from Pta. de los Baxios to the East end of the island, is altogether rugged, and may be considered as inaccessible.

FAYAL.—This island has been celebrated for its excellent pastures, fish, wood, &c. The air is always mild and pure; the cold of winter never felt, and the heat of summer always tempered by refreshing winds. Its inhabitants are computed at about 17,000. The island produces wheat and maize, sufficient for itself and a part of Pico. The cattle reared here are not sufficient for the consumption of the island, and supplies are, therefore, sent from the neighbouring Island of St. George, which produces a great number. The annual produce of wine is also scanty; for that which is exported hence is mostly from Pico, the opulent people of Fayal being owners of the best vineyards in that island, and they ship the wines from the Port of Fayal for the different ports of Europe and America.

Fayal, *when the point* (A) *bears N.E. by E. ½ E. by compass, and* (B) *E. by S.*

The chief town is the VILLA ORTA, on the S.E. side;* and there are, besides, nine villages on the island. The bay, on which the town is situate, represents, according to M. Adanson, a beautiful amphitheatre, clothed with trees. The town has more than 5,000 inhabitants, with numerous convents. The name Fayal is understood to be derived from *Faya*, the beech tree, with which, and other wood, the island abounds.

In the journal of Mr. Keilor, an intelligent master of the Royal Navy, this officer has stated that those who run for Fayal should not depend on the peak of the next island as a guide, because it is sometimes covered for five or six days successively.

Mr. Keilor adds, Fayal has a good bay, opposite to Pico, which is formed by an isthmus, extending to the S.E., and a point about 1½ miles to the north-eastward; the town has several fortifications, but in bad repair. Water, in general, is bad and scarce. A number of vessels, of all nations, here load with wines, dye-woods, fruits, and cheese.

The following is the DETAIL of the COASTS of FAYAL. The S.W. point is a mount, with a hermitage on its summit, dedicated to *Our Lady of Guia.* (*N.S. de la Guia.*) The North side of this is connected by a neck of land to a smaller mount, of a black colour, *Caimado*, at the foot of which the town of ORTA commences. Near the mount, on the West, is a sandy cove, *Port Pin*, where, in fine weather, some small vessels load and discharge their cargoes, but it is quite open to the S.W.

The northern point of the Bay of Orta is named *Espalamaca:* its bearing and distance from that of La Guia are N.E. ½ E. [*N.N.E. ½ E.*] 1¾ miles nearly. At the bottom of the bay is a beach of black sand, which commences near Point Espalamaca, and terminates at Mount Caimado. Within it is the town, facing the sea. In the latter are two very remarkable buildings, nearly alike: one of these is close to the sea-side, and was formerly called the Company's College; the other is in the most westerly part of the city, upon an eminence, and is the Carmelite Convent. These objects in a line bear nearly N.N.W. [*N.* 42° *W.*]

Nearly in mid-channel, between Fayal and Pico, is a rocky shoal of 3½ fathoms; it is about 20 fathoms in extent from N.E. to S.W. [*N.N.E.* to *S.S.W.*] and 10 broad. The marks for it are the Company's College and Carmelite Convent, above mentioned, in one; Point de Espalamaca, N. by E. [*N. by W.*] 2⅒ miles; and the hermitage of Guia, N.W. ¼ N. [*N.W. by W.* ¾ *W.*] 1⅘ miles. See, farther, the particular Plan in the large Chart.

The regular ANCHORAGE of FAYAL is in the bay opposite to the town of Orta. It is the best anchorage in the Azores, on every account, excepting that it is open to the winds from North to N.E., and from S.E. to S. W., and these winds are frequent in winter. That from S.E. is very destructive, it blowing right in. Those who anchor should, therefore, always be prepared for a start, on a shift of wind. The safest method is to let go the anchor in 35 or 40 fathoms, where the bottom is of sand, at about 1¼ miles from the town, which will be with the Point of *Joaõ Diaz* a little open to the right of Point

* See the particular plan of the channel between Fayal and Pico, on the Chart. For a farther description of these islands, see hereafter.

Espalamaca, and the Company's College in the town a little to the southward of the Carmelite Convent, already described. From this spot a ship may depart with any wind.

In the summer season, and favourable weather, the general anchorage is with the two buildings in the town as above described, but nearer to the town, in 25 fathoms, sandy bottom; small vessels proceed farther in, to 20 or 15 fathoms.*

To Sail in for the Road, if from the *northward*, no farther direction is requisite, as the way is perfectly clear. If coming in from the S.W., with a free wind, the regular passage is between the mid-channel shoal and Mount de Guia; or, if more agreeable, between the same shore and Pico, according to circumstances. With the wind from the West or N.W., take especial care to avoid the shoal, by observing the marks for it, above described.

If, on approaching the road from the S.W., the wind should be dying away from the eastward, and you intend to tack, so as to gain the anchorage, keep over toward Pico, within the distance of a mile or a mile and a half; because, at a little farther out, the bottom is rocky, and you cannot anchor, in case of necessity: besides, by proceeding thus, you will be free from variable eddy winds and calms, which are caused by the mountains; and the coast is sufficiently clear.

Southern Coast of Fayal.—The Point of *Santa Catalina*, which is 3¾ miles nearly W.N.W. [*W. ½ N.*] from Guia Point, is of low and black rocky land, and it, likewise, has a hermitage: between these points is the cove of *Feteira*, with its beach and village. Near it are several islets.

The Point *Castelo Blanco* is the S.W. point of Fayal. It appears like a little round mountain of moderate height, sloped on every side, so that, at a distance, it appears like an island. The coast hereabout is rocky, and affords no anchorage.

At the West end of Fayal are the two islets named *Capelinos*, lying in a South [*S.S.E.*] direction. Between them and the coast is a channel, which, in fine weather, admits fishing boats.

The Point of *Jorge Lorenzo* is the northern point of Fayal. Its upper part is high and sloping. From this point to the N.E. point *Riveirina*, the coast trends S.E. [*E.S.E.*] Point Riveirina is high and sloped, and forms a round front, of about half a mile; at the foot of it is a low point, with three islets. S.W. by S. [*S. by W.*] from this point, at 2$\frac{3}{10}$ miles, is that of *Joaõ Diaz*, which is low, black, and rocky, with rocks at its extremity. Between the points the coast forms a slender bay; the land is high and oblique, and it presents, near the middle, a remarkable slope of a red colour, which may be seen from the mid-channel shoal, called the Shoal of Fayal.

At nine-tenths of a mile to the southward from Point Joaõ Diaz is that of *Espalamaca*, on the North side of Orta Bay. It is high and sloping, with a small round front, having a vigia, or look-out, on its summit. Between these points the coast is a little indented, and has a beach, with a church at the bottom of it. Trading vessels at Port Magdalena, on the opposite side, when assailed by violent winds from the southward, frequently bear up, and find good shelter here.

Numbers of handsome baskets are made of willows in Fayal, which are frequently exported to the adjacent islands. They are generally red and white, part of the willows being dyed of a scarlet colour.

ST. GEORGE.—This island lies at the distance of 3 leagues from Pico, and is separated from Graciosa by a channel 8 leagues in breadth. It is a long, narrow island, about 9 leagues long, and little more than 1 in its average breadth. On its South coast is the little town called *Villa das Velas*, or *Vellas*, with a port where small vessels may lie sheltered from all winds.

This island, when Tofiño described it, contained more than 11,000 persons, in three towns and seven villages. He says that it produces much wine of a good quality, which it exports to Terceira and America. The island has been famous for its cattle, with

* Mr. Wm. Lane, agent to Lloyd's, in November, 1832, gave notice that, for the use of vessels passing through the channel between Fayal and Pico, or those requiring assistance from the shore, he had erected a flagstaff behind the *Castle of St. Cruz*, Fayal, and provided the telegraph flags of Captain Marryat, so as to enable them to communicate any information *they wish* to be reported, or to acquire immediate assistance in case of distress.

which it supplied other islands, and its cheese is said to be fine. The produce of wheat and maize is equal only to the consumption of a part of the inhabitants, as the lower class substitute the root of the yam. Wood and fresh water are abundant.

On the 1st of May, 1808, a dreadful volcano, seen from Fayal, burst out about the centre of this island, in the midst of fertile pastures, about 3 leagues S.E. of Vellas. On the 3rd, a crater was formed, in size about 24 acres. In two days it had thrown out cinders, or small pumice-stones, which a strong N.E. wind had propelled southerly; and which, independent of the mass accumulated around the crater, had covered the earth from 1 to 4 feet in depth, half a league in width, and 3 leagues in length; then, passing the channel, had done some injury to the eastern end of Pico. The fire of this large crater had nearly subsided on the 3rd of May; but, in the preceding evening, another small crater had opened, 1 league to the northward of the large one, and only 2 leagues from Vellas. The sulphureous smoke of the new crater rendered impracticable an approach to the large one. Within a mile of the crater, the earth was rent in every direction. The United States' consul of Fayal, who, with some friends, visited this place, stated that "they at length arrived within 200 yards of the spot; and saw it in the midst of a pasture, distinctly, at intervals, when the thick smoke, which swept the earth, lighted up a little. The mouth of it was only about 50 yards in circumference; the fire seemed struggling for vent; the force with which a pale blue flame issued forth resembled a powerful steam-engine, multiplied a hundred-fold; the noise was deafening; the earth, where we stood, had a tremulous motion; the whole island seemed convulsed; hollow bellowings were occasionally heard from the bowels of the earth, and earthquakes were frequent. After remaining here about ten minutes, we returned to town; the inhabitants had mostly quitted their houses, and remained in the open air, or under tents. We passed the night at Vellas, and next morning went by water to Ursulina, a small sea-port town, 2 leagues South of Vellas; and viewed that part of the country covered with the cinders before mentioned, and which have changed the most valuable vineyards into a frightful desert. On the same day (May 4) the party returned to Fayal; and on the 5th and succeeding days, from twelve to fifteen small volcanoes broke out in the fields they had traversed on the 3rd, from the chasms above described, and threw out a quantity of lava, which travelled on slowly toward Vellas. The fire of those small craters subsided, and the lava ceased running, about the 11th of May; on which day the large volcano, that had lain dormant for nine days, burst forth again like a roaring lion, with horrid belchings, distinctly heard at 10 leagues' distance, throwing up prodigious large stones, with an immense quantity of lava, illuminating at night the whole island. This continued with tremendous force until the 5th of June, exhibiting the awful, yet magnificent spectacle of a perfect river of fire (distinctly seen from Fayal), running into the sea. On that day, the 5th, its force began to fail, and, in a few days after, it ceased entirely. The elevation of the crater from the sea was about 3,500 feet. The lava inundated and swept away the town of Ursulina, and country houses and cottages adjacent, as well as the farmhouses throughout its course. It, as usual, gave timely notice of its approach, and most of the inhabitants fled; some few, however, remaining in the vicinity too long, endeavouring to save their effects, were scalded by flashes of steam, which, without injuring their clothes, took off not only their skin but their flesh. About sixty persons were thus miserably scalded, some of whom died on the spot, or in a few days after. Numbers of cattle shared the same fate. The consternation and anxiety were so great among the people, that even their domestic concerns were abandoned; and, amidst plenty, they were in danger of starving. Supplies of ready baked bread were sent from Fayal to their relief, and large boats to bring away the inhabitants who had lost their dwellings. In short, the island, heretofore rich in cattle, corn, and wine, is nearly ruined; and a scene of greater desolation and distress had seldom been witnessed in any country."

The Channels among the Azores are, in general, clear and deep, and may be navigated at all times: that, however, between St. George and Pico, should not be attempted, unless in settled weather, or with a steady breeze, for a sudden calm may prove fatal; as a strong current runs through the channel, according to the state of the tide.*

The Ponta del Topo is the easternmost point of St. George's Island. This point lies W. ¾ N. [*W.S.W. ¾ W.*] 30¾ miles from the summit of Mount Brasil, in Terceira.

* And we suspect, too, according to the state of the Florida Stream, especially when it flows from a high northern parallel.—Ed.

It is of moderate height, with rocks around it, and near its eastern part is a low islet, likewise surrounded by rocks.

From Pta. del Topo to Pta. del Norte Grand, the North coast presents nothing remarkable. There are several breaks on it, but it is mostly low and regular. Hence to the West end of the island, Pta. de Rosales, it is more rugged and barren. Off the point last mentioned are several islets, of which two very high pyramidal ones are remarkable; one of these is at the foot of the point, and the other half a mile to the S.W. of it. To the *W. by S.*, *true*, of Point Rosales, the pilots say that there is a rocky shoal of 7 fathoms. The sea may break over it in a storm.

From Pta. de Rosales to the *Morro Grande* (Great Hill), near the Port of Velas, the coast trends S.E. by S. [*S.E. by E.*] The Morro is high, of a blackish colour, and has a vigia, or look-out, on its summit. To the N.W. of the Morro, and on its skirt, is an indent of the coast, wherein several vessels have been lost, by mistaking it for the Port of Velas, the bottom being all rocky, and a vessel, once in, cannot leave it without a change of wind.

Puerto de las Velas.—At 1¼ miles S.E. by E. [*E. by S.*] from the outer point of the Morro Grande is *Pta. la Caimada*, rather low, with a small castle. Between the two points is the Bay or Port of Velas, sheltered from winds from N.W., by the N., to S.E.

In the bottom of the bay, on the shore, is the town of Velas or Vellas, the chief town of the island, and on the S.E. side of this is a small mole, having 3 fathoms within it, but with rocky bottom. The regular anchorage is to the South [*S.S.E.*] of the mole, in 9 fathoms, fine black sand. Vessels moor with two anchors to the N.W. and S.E. This is a place of little consideration.

From Point Caimada, on the eastern side of Port Velas, the coast by the sea continues low and rocky, but the land within rises to a good height. Thus it continues to the Pta. de los Monteros, the S.E. point of the island, which is high and sloped. Four leagues from the Bay of Velas is the *Point de Caleta*, whence a high mountain rises, with a gentle acclivity, and close to it, on the East, is a town of the same name, whence much wood is exported to the neighbouring islands.

GRACIOSA.—Graciosa is said to take its name from its beauty and fertility in corn, fruit, pasture, and cattle; supplying Terceira and several of the other islands with a great part of its produce. It is the most fertile of all the Azores, and has about 8,000 inhabitants, distributed in two towns and two villages. The greatest extent of the island is only 8½ miles, but in this extent the quantity of barley which is produced is almost incredible, together with wheat, maize, wine, all kinds of fruit and vegetables. Of sheep, hogs, and fowls, the inhabitants have more than they can consume. The only scarce article is wood, for this is obtained from St. George's and Pico. The chief town is *Santa Cruz*, on the N.E. side.

Ponta Blanca is the S.W. point, and Carapacho the S.E. The mountains over these points appear at a great distance like islands, particularly on approaching the South side from the S.W. Point Carapacho is low toward the sea, and has several islets about it; but at a little distance inland it is high and craggy. At two cables' length S.E. [*E.S.E.*] from the point is the Islet *Abajo*, with others in its vicinity; but between it and the point the largest ship may pass, should it be necessary, to the anchorage of *Praya*, on the eastern coast.

Between the Point Carapacho and the Ponta dos Fanaes, 1¼ miles N.E. ¾ N. [*N.* 14° *E.*] the coast is almost uniform and clear. At the last, the Bay of Praya commences, the North side of which is *Pta. Negra;* the bearing and distance between are N. ¼ E. [*N.* 15° *W.*] 1½ miles. Pta. Negra is low and rocky, and near it stands the town of Praya.

An islet, called the *Isle of Praya*, lies at half a mile East [*E.N.E.*] from Point Negra; it is low on the West side, but rather higher on the East, and there is a passage between it and the point. At the distance of a cable and a half to the southward of the islet is the anchorage.

At 3 miles North [*N.N.W.*] from Point Negra is the Point of Josef Ferrer, which is very low, being even with the water, and having a dangerous shoal, at about 2 cables' distance to the East [*E.N.E.*]. The coast between these points is rather regular than otherwise, with a few little bights; of these bights, the first is close to Point Negra.

The best anchorage about the island is with the Islet Abajo, lying near the S.E. point, in a line with the westernmost part of Praya Isle, or, rather, a little open; this is off the southern extremity of a great slope of land, extending toward the Point of Josef Ferrer. The depths are from 30 to 40 fathoms, sandy bottom. Here vessels load and unload, and are ready to be off with any winds; but they lie sheltered only from South by the West, nearly to North. All the goods from the town of Santa Cruz are brought to this anchorage to be shipped, as they have no other.

On the West of the Point of Josef Ferrer are the bay and town of Santa Cruz. The coast is low, and the land rocky, with scattered fragments of rock about it. Close to the town, on the S.W. side, are three small hills near each other, and a church is on the highest part of every one of them. These, therefore, are good marks for the North side of the island.

The *Ponta da Pico Negro* is the North point of the island; it is high, oblique, and of a very black colour. The coast hence to the S.W. continues high and rocky. From the *Pta. de Fozzo de Porco*, the western point, half a mile S.W. by S. [*S. 10° W.*], is the Point of *Jorge Gomez*, low and rocky, with a church near it. At 3¾ miles from that point is *Point Blanca*, very high and sloping, within which, at a short distance, is the highest mountain on the island. The coast between is of high rock. On the summit of Pta. Frayle, northward of Point Blanca, is a stone that resembles a man.

At S.E. ¼ S. [*S.E. by E. ¾ E.*] 2¼ miles from Point Blanca is the low and rocky Point of Folgo; the coast between forms a bay, and the village of Folgo is at the bottom of it.

FLORES.—This island contains about 7,000 inhabitants. It has two towns, both on the eastern side, *Sta. Cruz* and *Lagens*, and four villages. The chief productions are yams, wheat of excellent quality, cattle, sheep, and hogs, cloths and woollen stuffs. The exports are wheat, cloths, bacon, with the weed or moss called orchilla, used for a dye, as already noticed. The latter is found clinging to the rocks and declivities, and is not obtainable without great trouble and danger.

The island is very mountainous, but much more so towards the South than the North. The town of Santa Cruz is in lat. 39° 29′; and to the N.W. of it, in the interior of the island, is a remarkable peak. The land is well cultivated, and has abundance of water, falling down, in numerous cascades, from the heights.*

Of Ponta del Gada, the North Point of Flores, the position is shown in the Table, page 52. This point is of moderate height, smooth on its summit, not very projecting; but at its base is a cluster of islets, extending outward a quarter of a mile; the ground around them is clear.

Ponta Ruiva, the N.E. point of Flores, is high, sloped, rugged, and obtuse. At the foot of it is an islet, called the *Pan de Azucar*, or Sugar-loaf: a fishing-boat may pass between. In the bay to the westward of Pta. Ruiva there is anchorage in 25 fathoms, sandy ground, sheltered from winds from S.E. by the South to W.S.W. It is frequently resorted to for water, or by vessels that are compelled by the wind to quit the eastern side of the island.

The *Point of Santa Cruz* is 2¾ miles S. ¾ E. [*S.S.E. ½ E.*] from Point Ruiva. It is low and rocky, with several rocks about it. In the interval is the Islet of Alvaro Rodriguez, very near to the coast; and to the S.E. [*E.S.E.*] of this is anchorage, in 36 fathoms, sandy bottom, sheltered from the West and S.W. At *true* South, three-quarters of a mile from the point, is the castle of Santa Cruz, which is very near to the town, the principal port of the island.

At 1¾ miles southward from the castle of Santa Cruz is *Ponta Cabeira*, low and rocky land, which rises with a gentle acclivity to the distance of a mile. Between these points the coast forms a bay, with a beach and a small river at the bottom of it. This bay is the best anchoring place about the island, and is sheltered from all points between N.N.E. by the West to S.W. The proper depths are in from 35 to 40 fathoms, sandy ground. This is the nearest anchorage to Santa Cruz, and therefore the most frequented.

At 1½ miles S.W. ½ W. [*S.S.W. ¾ W.*] from Point Cabeira is that of Loma, which

* The anchoring ground about the island is generally at beyond the distance of a mile from land. Within that distance the ground is rocky, and much farther out it is the same.

is high and oblique; between these points the coast forms a bay, with a beach and small river at the end of it. A vessel may anchor in this bay, in 25 fathoms, sandy bottom, but it is not so well sheltered as that to the northward, being open to easterly and southerly winds.

From the Point of Lagens, which is 4 miles to the south-westward of Point Loma, a ridge of rocks extends to the distance of a cable and a half to the S.S.E. At 2¼ miles S. ½ W. [*S. by E. ¼ E.*] from Point Lagens is a rock or shoal, of 4½ fathoms: its size is about that of two ships, and appears, when near to it, like a large flagstone. Between it and the coast is a great depth of water, and the same about it.

In the little bay, on the North side of Lagens Point, is the town of LAGENS, having a large church, which is a useful mark for this part of the coast. A vessel may anchor very well in this bay with a wind between North by the West to S.W. by W., in 25 fathoms, sandy ground. This anchorage is much frequented, because a vessel can here get under way more easily than at Santa Cruz, having better room for working out.

From Lagens Point westward, the coast rises in height to the *Point de Roca Alta*, at a little distance from which, toward the North, is the highest part of the island. The Point of Lope Bas, which is nearly a mile W.N.W. ¾ W. [*W. ¼ S.*] from Lagens Point, is low by the sea, but within, high and sloping. That of Roca is 1¼ miles farther, is obtuse, very high, sloping, and black. The coast here is nearly straight, high, and rugged.

The Ponta de los Ilheos Agua Caliente, which is low and rocky, is so called from a mineral spring which exists here, and of which the water is hot. Between this and the Point Roca Alta is a bay, with anchoring ground in 25 fathoms, sandy bottom. There are several islets at the foot of the former point.

The *Pta. de Catarinas*, with its islets, lie 1⅓ miles more to the northward. The coast between is wholly rocky. At 1¾ miles farther to the N.N.E. is *Pta. dos Bredos*, high, sloping land of a whitish colour, with islets at its base. One of the latter, on the South side of the point, resembles a column. The coast between affords anchorage, in 20 or 25 fathoms, sandy ground.

The *Pta. del Baxio*, which is very low, is 2¾ miles to the northward of Pta. dos Bredos. The coast between is rocky, but you may anchor off it in 32 fathoms of water, sandy ground, and sheltered from N.N.E., East and South. Close to Baxio or Shoal Point is a very remarkable church, that of S. Pedro, or St. Peter.

FANAES.—At 2⅓ miles N.N.E. ¾ E. [*N. 6° E.*] from Baxio Point is that of Fanaes, which is not very high by the sea, but it forms abruptly like a mountain, and is of a black colour. The bay in the interval is that of San Pedro, which has anchoring ground, in 25 or 30 fathoms, bottom of sand; and here water may be readily obtained from a cascade that falls from the mountains, by means of a hose, so as to fill the casks without taking them out of the boat. The Islet Monchique lies at rather more than a mile N.W. ¾ W. [*W.N.W. ¼ W.*] from Point Fanaes. The depth between is sufficient for any ship.

The following observations upon this place are by Mr. E. May, Master of H.M.S. *Skylark:* *

"At daylight, bore up for the Bay of Fanaes; at 5^h 10′, shortened sail and sent a boat for water. Found a great surf on the beach, which consists of large stones, none smaller than a man's head. These stones extend from the beach 2 or 3 boats' length, making it dangerous for boats to land.

"The best landing-place is a passage between a point of rocks that lies to the South of the beach. From thence you may procure water, from a fountain, about half a mile from the beach, employing small casks, and at the rate of three to five tons per day, by employing natives, if the weather is fine, and the wind between S.S.E. and N.E. With any other wind, particularly if blowing hard, there would be too much surf, and the passage too narrow, in such weather, to enter. This place may be known by a very high, steep mountain, a little to the left of the landing-place, from whence the Island Monchique bears N.W. 1½ miles. Between the island and the shore is a clear passage for any ship; but she should borrow towards the rock, as a reef projects about a cable's length from thence, although there are no hidden dangers in the passage.

* *Nautical Magazine*, March, 1842, p. 153.

"At this place, by the assistance of shore-boats, about four tons of water were obtained in ten hours. The place abounds in poultry, sheep, pigs, vegetables of all kinds, and eggs, all very cheap, and were freely exchanged by the natives for old clothes. Those who came off to the ship were well-dressed, clean, healthy people. The shore of the island is bold, and may be approached to the distance of a quarter of a mile. Leaving Fanaes, I would recommend vessels to run due West for 2 or 3 miles, to get clear of the high land to the North of the landing-place, by which they would avoid being becalmed under this land when the wind is from N.E. to S.E., and would be enabled to run clear of the island. Corvo has also a bold shore, and can be seen off deck 55 miles distant, as was proved by us the day after leaving the island, both by log and observation. Flores may be seen still farther off, as it is higher than Corvo."

PONTA ALBERNAS is the N.W. point of Flores. It is moderately high, sloped, and of a red colour. Between it and Point Fanaes is the islet of *Maria Gadella*, which is high and round. W. ¾ N. [*W. by S.*] from this islet is anchorage, in 30 or 40 fathoms, sandy ground. From the point eastward to Pta. del Gada, already described, the coast is entirely rocky.

Between Pico and Flores, and off the latter, it is stated that some rocks exist. They were announced by M. M. Ferreira, of the Brazilian brig *Constante*. The first showed above water, at low water, in lat. 37° 56′ 20″ N., lon. 33° 4′ 8″ W., and has been named *Constante Reef*. The second, *Ferreira's Reef*, is nearer the islands, and in lat. 38° 26′ 44″, lon. 38° 25′ 10″; the sea broke on this. Nearly on the same reported position as the first reef, another announcement, under the name of the Rhoon Rocks, was issued, in the *Nautical Magazine*, July, 1844. This was an extensive group of rocks, some of them more than 16 feet above water; lat. 38° 32′, lon. 33° 16′. These reefs are noticed hereafter, in the Descriptions of the Shoals, &c., of the Atlantic.

CORVO is the northernmost of the Azores, and is formed by a single volcanic mountain, 3½ miles long, North and South, and 2¼ East and West, or 9½ miles in circuit. The extinct crater of this mountain is called the *Caldeira*, and occupies all the N.W. part of it, and is 3¼ miles in circumference. The highest part of the ridge surrounding the Caldeira is on the S.W. side, and is 2,548 feet in height. The East and West margins are lower, in some places not exceeding 1,434 feet. Its bottom is occupied by two small lagoons, the surface of which is 1,273 feet above the sea, and 1,275 below the highest peak. The bottom is cultivated and used for pasturage, as indeed the greater part of the island is. The summit, even in summer, is so frequently capped with clouds, that rills of water were running down the mountain in the month of August.

The lower land of the S.W. end of the island has all the appearance of being added to the original portion by an eruption of lava, and is diligently cultivated. The only habitations on the island are comprised in the village of Corvo, standing on the East side of the South point, on a rising ground close to the coast, and containing 160 or 170 thatched stone houses. They are dirty, and have an uncomfortable appearance, separated from each other by filthy lanes. At the South end of the village stands the church, a small stone building with a square tower and short spire, which, being kept well whitewashed, is a good seamark. About 250 yards S.W. by W. from it there is a little rocky hill, surmounted by an antique horizontal mill. The population in 1843 was 784 persons; 383 males, 401 females. They are poor, primitive, and contented. The church is in lat. 39° 40′ 9″ N., lon. 31° 7′ 16″ W.; variation, in 1842, 27° 30′ W. It is high water, full and change, at 12^{h} 25′, and the rise of tide 3 feet 6 inches.

Ponta de Pesqueiro-alto is the South end of the island. On its eastern side, facing the village, is a small stony beach, where a few fishing-boats are hauled up. *Ponta de Casa* bears *N.* 52° *E.* 1⅓ miles from it. It is a sharp, well-defined point; and at the distance of 60 or 70 yards from it there is a rock just visible above water, on which the sea, at times, breaks violently, and there is a similar rock a quarter of a mile N.N.E. of it. *Ponta de l'Este* is the next point, and is *N.* 16° *E.*, distant 1 mile; and the next is *Ponta de N.E.*, a bold bluff, 760 feet high, 1 ' miles *N.* 16° *W.* from the last. The cliffs increase in altitude as you proceed northerly; and to seaward of the Ponta de N.E., bearing *N.* 51° *E.*, one-third of a mile off, is a small block of rock, steep-to on all sides, with 3 or 4 feet over it at low water. Proceeding north-westward, the next point is *Joaõ de Moira*, *N.* 57° *W.* two-thirds of a mile, and thence to the North extremes, *Ponta de Norte*, *N.* 79° *W.* about the same distance. The coast between these points presents a series of high inaccessible cliffs, fronted, as before, by a narrow belt of stones. From the top of

the cliffs the land rises with great abruptness to the margin of the Caldeira, a height of 2,200 feet, where the horizontal distance from the sea does not exceed 2,500 feet. Ponta de Norte is a high rock, 368 feet high, jutting out 150 yards from the coast, inaccessible from the sea, and, when seen from East or West, shows an overhanging face to northward. About West from this, one-third of a mile, is a small elevated islet of naked lava, and S. 47° W. one-fifth of a mile from this, is *Ponta de Turrais*, the N.W. extreme of the island. It is very remarkable; it runs directly down from the North edge of the crater into the sea, a sharp, serrated ridge of dark lava. At 300 yards North of it, with Ponta de Norte bearing *East*, there is a sunken rock, on which the sea breaks violently. In rounding the island it will be advisable not to near this point in less than 20 fathoms, or half a mile distant.

The next extreme point, South of Ponta Turrais, is *Ponta d'Oueste*, bearing *S.* 14° *W.* 1¾ miles, the coast between being partly a steep declivity, covered with shrubs and wild vegetation. To the southward of this the coast consists of lofty cliffs, and at nearly three-quarters of a mile South of it is a small, low, detached rock, named *Ilheo de Mulher*, 50 yards off the beach. From this the coast runs *S.* 27° *E.*, a mile to the *Sugar-loaf Rock*, a mass of lava standing at the base of a bold cliffy point. Hence to the southward the coast consists of a ragged outline of steep cliffs, and then a low coast of very broken outline, fronted by innumerable rocks, to the meridian of the old horizontal mill previously mentioned. This portion of the coast is fronted by innumerable rocks, projecting from the shore in narrow ridges of broken lava to an average distance of 200 yards. In strong winds the sea rolls over them in enormous breakers, but the danger is not so wide as they appear to be.

The bank surrounding the island is generally steep, and very abrupt on its outer edge. At Ponta de Casa it is 1 mile from the point. At Ponta de Norte, 1¼ miles; or a quarter of a mile, 12 fathoms; half a mile, 30 fathoms; three-quarters of a mile, 40 fathoms; 1 mile, 40 fathoms. Along the N.W. side the bank is comparatively shallow and rocky, to the extent of half a mile from the land, where there are 15 fathoms, and the edge of the bank is 1¾ miles off. Off the South point it does not reach to 1 mile off.

A short distance to seaward of the rocks in front of the cliffs near the village, and with the church bearing N. 31° W., three-tenths of a mile distant, lie three patches of sunken rocks, on which are 3 and 4 fathoms water. They are steep-to. There are no dangerous rocks before the stony beach in front of the village, but the surf which usually plays upon it makes the cove to the westward of the mill a preferable landing-place.

The best anchorages at Corvo (mentioned by Tofiño) are on the westward side, between the parallels of the Ilheo de Mulher and the Sugar-loaf Rock: 30 to 35 fathoms, fine brown sand, about 1 mile off shore; and on the eastern side, in 25 to 30 fathoms, sandy bottom, about half a mile due East of Ponta de Casa. Captain Vidal cannot advise the adoption of these anchorages, nor of any others the island may afford, except as a matter of necessity.

It has no fuel to spare, no facility for watering, nor, indeed, anything to offer which cannot be most abundantly and conveniently obtained at Flores; whilst from its size and form it affords little shelter from wind or sea.

The flood tide sets upon the island N. 30° E., and the ebb in the opposite direction, at an ordinary velocity, in springs, of 1½ miles per hour. When this is opposed by a gale, it occasions a very high, confused sea, as it sweeps over the rocky, uneven bottom at the North and South points.*

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4. THE ISLANDS OF MADEIRA AND PORTO SANTO.

PORTO SANTO, &c.—Ships from the ports of Europe, when bound to Madeira, are recommended to make, in the first instance, the Isle of PORTO SANTO, and thence proceed for the Road of Funchal, on the track shown upon the particular plan given in the Chart. The land of Porto Santo is very remarkable, and may be seen, in fine weather, 15 or 20 leagues off. It first appears in two or three very high hummocks, by which it is distinguished from Madeira, and the little isles named the *Desertas*.

* Extracts from a description of Corvo, by Capt. A. T. E. Vidal, R.N., *Naut. Mag.*, Jan., 1850, p. 1, *et seq.*

Porto Santo (a) bearing South, 14 miles, as taken by Captain J. W. Monteath.

It is said that it was discovered by two Spaniards in a voyage to explore the coast of Africa, but being driven off in a storm, they here found shelter, and named it, in consequence, Porto Santo. At present it is a dependency of Madeira, and in 1838 its population amounted to 1,618 persons. It is $6\frac{4}{10}$ miles in length from N.E. to S.W. Its mean breadth is $2\frac{1}{2}$ miles, and its circuit 17 miles. The surrounding bank of soundings is more considerable than has been supposed. The N.E. part consists of numerous rocky pointed mountains, some nearly 1,700 feet in height, and all its North coast is generally high inaccessible cliffs, with detached rocks at their bases. The central part is much lower than the extremities, but on the North and N.W. coasts rises to 700 feet; from whence it slopes to the South, and terminates in a beautiful white sandy beach, which forms its entire S.E. shore. On this central part are several sandfields, covered with what appear to be fossil heath-stems, probably coral formation. The S.W. end of the island is also rocky and elevated, some of the hills exceeding 900 feet in height. The town, *Villa Baleira*, is situated near the centre of the bay on the S.E. side, about 300 yards from the beach. The church and court-house on it are conspicuous; and a little to the West of them is a small battery, in lat. 33° 3′ 30″ N., lon. 16° 20′ 14″ W.; variation in 1843, 24° 30′ W.

The Pico de Castello, 1,447 feet high, is N. $4\frac{1}{2}$° E. from the church; and on its summit are the ruins of several water tanks and stone buildings. The two peaks immediately to the East, called Fachio and Guadaya, are the highest in the island, the former being 1,660 feet high.

The island is chiefly used for pasture, cultivation extending along the shore of the bay and the low land. The island suffers grievously for the want of water, but producing wine, grain, and vegetables; also plenty of live stock and poultry. The banks around abound with fish.

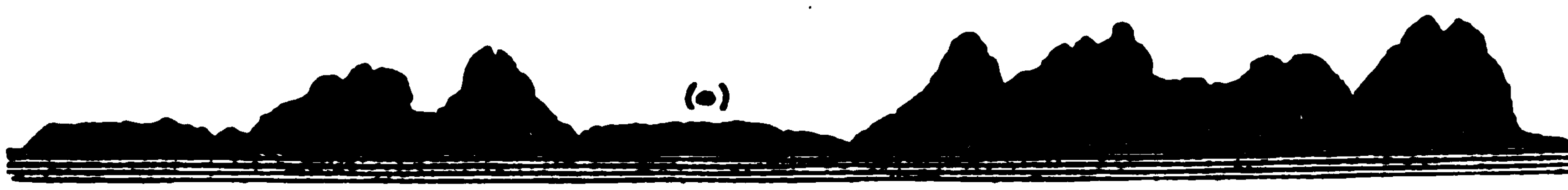
The landing at Porto Santo is usually made upon the beach in front of the town, though there are no artificial facilities for so doing. It is high water, at full and change, at 12^h 50′; the rise of the tide is 7 feet. Generally, vessels should not anchor in the bay within the line joining the South extreme of Ilheo Baixo and the low extreme of Ponta de Incao, bearing S. $49\frac{1}{2}$° W., and N. $49\frac{1}{2}$° E., and the South point of Ilheo de Cima N. 73° E., 2 miles distant. In this position, which is $1\frac{8}{10}$ miles from the landing-place, there will be 17 fathoms water, over a bottom of small gravel and broken shells. The edge of the bank is rather less than half a mile to the South of it; the depth of water increasing rapidly. During the settled weather in summer vessels may anchor nearer the shore, but care should be taken not to be caught in the bay. In the present condition of the island it is of little service to the navigation, as Madeira itself offers superior advantages.

Ponta de Incao, the S.E. point, is composed of high rocky cliffs. Off it lies the *Ilheo de Cima*, a table-topped island, 360 feet high. There is a boat passage inside it. Off it is a good fishing station. *Ponta dos Frades*, a bold point, steep-to, is 1 mile N. by E. from Ponta de Incao, and between them is the small sandy bay of *Ponta dos Frades*. *Ponta Branca*, the N.E. point of the island, is composed of three bluffs, the northern one of which forms a fine, bold promontory, the peak of which is 1,390 feet high. These rocky islets, steep-to, with navigable channels between, lie off the Ponta Bronca. The outer, or *N.E. Rock*, is 330 feet high; the rocky bank, on which they stand, has a patch of 10 fathoms at $2\frac{1}{4}$ miles N. 32° W. from the N.E. rock.

Off the S.W. point is *Ilheo de Ferro*, 380 feet above the sea, almost inaccessible, and having a narrow but safe channel inside it. *Baixo Island*, off the South point, *Ponta de Calheta*, is $1\frac{1}{2}$ miles in length, and is only visited for its limestone quarries, a singular feature. They are national property.

Off the N.W. coast of Porto Santo the bank of soundings extends for 8 miles, with a general depth of from 25 to 35 fathoms, fine white sand. Near its N.E. margin is the Falcon Rock, the position of which was first ascertained by the officers of H.M.S. *Falcon*, Lieutenant J. Bowen, in January, 1802. It is a mere knoll, on which there are

4½ fathoms at low water. It is said to break at times. When on the rock the highest land of the N.E. rock bears S. 60° E. 6¼ miles; of Ilheo de Fonte, S. 13° 10′ E. 4$\frac{6}{10}$ miles; and of Ilheo de Ferro, S. 5° 30′ W. 8$\frac{5}{10}$ miles. Vessels coming from the N.E., with a fair wind, may pass it, keeping the Ilheo de Fonte (off the middle of the North coast) in line with the high land at the S.W. end of Porto Santo. At nine-tenths of a mile N. 37° W. from the Falcon Rock is a shoal patch of 11 fathoms, named the *Styx Bank.**



Porto Santo (a) N. by E. 12 miles; taken by Captain Monteath.

DESERTAS.—To the S.E. of Madeira, the Desertas, a line of narrow rocky islets, extend nearly in a North and South direction by compass, the North extremity of which bears S. 34° 8′ E. 10 miles distant from its East point. Between them in this space is a bank of soundings of from 45 to 75 fathoms, about 2 miles broad, on which, in settled weather, fishing-boats frequently anchor. This bank continues quite round the Desertas.

Chao, the northernmost, is nine-tenths of a mile in length, and one-quarter of a mile in width at its North end. It is tabled land, surrounded by high rocky cliffs. Off the bold bluff at the North extreme is a remarkable detached rock, called by the Portuguese the *Furrilhao*, but known to navigators as the *Sail Rock*. It lies due North of the point, 100 yards distant, and is 160 feet high. At 300 yards N. 65° W. from it is a breaking rock, and a narrow ridge of irregular soundings extends from it N. 30° W. nine-tenths of a mile. The surface of Chao is composed of light soil, with rocks and stones, covered with long coarse grass, and a few aromatic herbs. Near its centre is a pond of turbid water. The highest land is near the North point, and is 336 feet in height.

The *Deserta Grande* is the largest and most elevated of the three islands. It is 6¼ miles in length by 1 broad at the widest part. From *Ponta de Pedregal*, on the West side, to its South extreme, it consists of a continuous chain of rocky heights, the highest peak of which, 1,610 feet, lies 1$\frac{1}{10}$ miles *E.S.E.* of the point. The width of the passage between Chao and the North point of Deserta Grande is but little more than 300 yards between the rocks, and this is further contracted by a breaking rock in the centre, so that it is only practicable for boats in fine weather. *Ponta de Pedregal* is 2 miles from the North end. It is a detached rock, with high land towering above it to more than 1,200 feet in height. Between this point and the next to it to the North is the little cove of *Castanheira*, where there is a boat landing-place, marked by a detached rock. *Pontu de Boqueirao*, the South point, is 4½ miles *S.* 30° *E.* from Pedregal, with a rock close to it, but the point is steep-to and clear. The East coast is a rugged, broken, irregular line of cliffs. Northward of Point Pedregal the island is differently formed to what it is southward, consisting here of two ridges, with a ravine between them. At the head of this valley or ravine, at the foot of a green hill near the centre of the island, about East of Pta. Pedregal, is a small house, and near it two ponds or reservoirs of turbid water; and a few yards down the valley is a delicious spring, though yielding but a limited supply.

The *Bugio, or Southern Deserta*, is about 4½ miles in length. Its greatest breadth is not half a mile. The passage to the North of it is two-thirds of a mile in width, and is perfectly clear; depth 19 to 20 fathoms, and 7 fathoms within 30 yards of either point. Both shores are rocky cliffs, of less altitude than the Deserta Grande, surmounted by a very sharp serrated rocky ridge of hills, which runs the whole length of the island. There is a gap in this ridge, near the centre of it, which at a distance gives it the appearance of two islands. The highest peak on the North part is 1,349 feet, and on the southern part, 1,070 feet, in height. *Ponta d'Agulha*, the South extreme, has a few rocks, quite close to it, but 5 fathoms at 130 yards off. It is in lat. 32° 23′ 15″ N., and lon. 16° 27′ 37″ W.

The bank of soundings round these singular islands is tolerably regular, extending 1½ miles from the East side, and 2 miles on the West side; and in a narrow ridge to Madeira as before mentioned.

* Extracts from a description by Captain A. T. E. Vidal, R.N.

The islands have no permanent inhabitants. They are frequented for orchilla; and on the centre one some cattle and sheep are pastured, and attended by a few casual visitors.

There is much danger to vessels passing close under the lee of these islands with strong breezes, in the violence of the gusts from the high land, which are most variable, both in direction and strength. It is no uncommon thing to see the water whirled into the air, and then precipitated on the vessel's masts and decks.

The tide sets by these islands at springs at the rate of 1½ to 2 miles per hour. The flood *N.* 31° *E.*, and the ebb S. 31° W., and its rise is 7 feet.

The Southern Deserta S.W. by W. 6 miles; taken by Captain Monteath.

MADEIRA.—The date and manner of the discovery of this beautiful island are involved in some obscurity. The most probable is the romantic tale of Robert Machim and Anna D'Arfet, two lovers, who, fleeing from the wrath of the lady's friends to the shores of France, were driven by a storm far away to sea, and at length met with this unknown and uninhabited island. Here they landed, and both died, the crew again departing. There are some variations in this story, both in date and particulars, but about 1344 is mentioned as the time. There is great probability of its accuracy; and in the present little church of Machico is said to be preserved a portion of the cross found over their graves, on their re-discovery between 1417 and 1419. This later discovery arose from the circumstance of a dark cloud being constantly seen in the S.W. by the settlers at Porto Santo, who had gone from Spain to the conquest of the Canaries. They sailed towards it, and on June 1st, 1419, they discovered the point now called, after their vessel, Cape San Lorenzo.

Madeira is of volcanic origin, though the only sign of a crater is upon San Antonio (5,076 feet), near Machico, at the East end of the island. It is a collection of mountains, the highest of which, the *Pico Ruivo*, is near its centre, and is 6,056 feet high.* To the West of it the ridge of the *Lomba Grande*, nearly of equal elevation, extends for 2½ miles, and forms the North edge of the stupendous ravine of the *Curral*, one of the wonders of Madeira. The western side of this is formed by a ridge, of which the rocky summit of the *Pico Grande* is 5,391 feet high. South of Ruivo is a ridge of peaks of nearly equal elevation, amongst which the three remarkable peaks of the *Torrinhas* are 5,980 feet high. South of these, three-quarters of a mile, is *Pico Sidrao*, and half a mile farther S.E. is *Pico Arriero*, 5,893 feet high. These may be considered to form the axis of the island, from which the mountains generally slope gradually to the South coast, and on the North, with few exceptions, they drop precipitously on to the bold high coast.

The cultivation is confined to the coast, or to the bottoms of some of the valleys, and occupies altogether a very small proportion of the surface. Vines form the chief feature; for the corn grown annually scarcely supplies a two months' consumption to the inhabitants.

In the island may be found almost every European and tropical luxury. The myrtle, the geranium, the rose, and the violet, may be seen on every side. The geranium, in particular, is so common, that the honey of the bees is strongly impregnated with its odour.

Nearly all the productions of the tropics are cultivated here with success; and the guavas, citrons, bananas, and custard-apples, are even considered as superior to those of the West Indies. The vegetables are the same as those of England, and generally of much the same quality. The same garden which supplies the dessert gives likewise the coffee which closes it, and of the finest kind.

Captain Wilkes, in command of the U.S. Exploring Expedition, arrived at this island September 16, 1838, on his outward voyage; from his fine work we extract the following:—

"The first appearance of Madeira did not come up to the idea we had formed of its

* The distance to which the mountains of Madeira ought to be seen from a vessel's deck is about 90 miles; but, of course, at this low elevation it would require a very clear atmosphere. Sir Andrew Lang says, that on leaving Madeira for the West Indies, December 26th, 1822, the Pico Ruivo was distinctly visible when the ship had reached 75 sea miles from the anchorage at Funchal, bearing N. 41° E., at $2\frac{1}{2}^{h}$ p.m.; lost sight of it soon afterwards, from the thickening atmosphere.—*Naut. Mag.*, 1847, p. 261.

beauties, from the glowing descriptions of travellers. It exhibited nothing to the distant view but a bare and broken rock, of huge dimensions, which, though grand and imposing, is peculiarly dark and gloomy, and it was not until we made the land that we could discover the green patches which are everywhere scattered over its dark red soil, even to the tops of the highest peaks.

"The mountain verdure was afterwards discovered to be owing to groves of heath and broom, which grow to an extraordinary height, aspiring to the stature of forest trees. In addition to these groves, the terraced acclivities, covered with a luxuriant tropical vegetation, change, on a closer approach, its distant barren aspect into one of extreme beauty and fertility.

"The most striking peculiarity in the mountain scenery is the jagged outline of the ridge, the rudely shaped towers, and short pyramids of rock, which appear elevated on the tops and sides of the highest peaks, as well as on the lower elevations, and the deep precipitous gorges, which cut through the highest mountains almost to their very base.

"The shores of the island are mostly lofty cliffs, occasionally facing the water with a perpendicular front, one or two thousand feet in height. The cliffs are interrupted by a few small bays, where a richly cultivated valley approaches the water between abrupt precipices, or surrounded by an amphitheatre of rugged hills. These narrow bays are the sites of the villages of Madeira.

"Off the eastern cape of the island many isolated rocks were seen separated from the land, with bold abrupt sides, and broken outlines. The character of these rocks is remarkable: they stand quite detached from the adjoining cliffs, and some of them rise to a great height in a slender form, with extremely rugged surfaces, and broken edges. Through some, the waters have worn arched ways of large dimensions, which afford a passage to the breaking surf, and would seem to threaten, ere long, their destruction.

"Similar needle-form rocks are seen off the Northern Deserta, an island lying some miles East of Madeira. One of them is often mistaken for a ship under sail, to which, when first seen, it has a considerable resemblance. It stands like a slender, broken column, several hundred feet in height, on a base scarcely larger than its summit."

At Madeira is a wind called the *Leste*, which, as its name implies, comes from the East, although all East winds are by no means *Lestes*. It appears to be of the same kind as the *Harmattan* of Western Africa, and is of a hot, close, drying nature, particularly oppressive to some constitutions, which it affects by languor, head-ache, and a parching of the skin and lips. What is remarkable, the residents are those whom it most disorders in this way. Visitors, in general, suffer much less; and the invalids are never so well as while it lasts. A peculiar clearness and cloudlessness in the atmosphere are among the invariable indications of Leste, and the weather during its continuance is most delightful; the sky of a deep blue, so stainless, that one might fancy it had never been sullied by a cloud; with a transparency in the atmosphere, which, like the effect of moisture, seems to bring out fresh hues from every object.

At times, but not frequently, the Leste is accompanied by a strong wind, but the weather is still delightfully warm and pleasant. The nights, too, are delicious; soft and balmy; and, with the moon walking in summer brightness, and the orange trees in flower, the air is loaded with perfume. With the departure of the Leste, rain almost invariably follows.

The climate, generally, is delicious, and strikes with peculiar charm to a stranger, whom a short sail has transferred to it from the very midst of the gloom and chill of an English December. Indeed, the great natural distinction of Madeira is the climate, which, perhaps, taken altogether, is the finest in the world. The bitterly cold winds, which, during some seasons, prevail on all the shores of the Mediterranean, are never felt at Madeira. Of winter there is, properly, none; a peculiarity not so remarkable as the fact of the comparative mitigation of the summer heat, which, except in particular situations, hardly exceeds that of an ordinary hot season in England. The perfection of the climate consists in this uniformity of its temperature. It differs, perhaps, less in summer and in winter than in any other spot North of the tropic. The thermometer commonly ranges from 60° to 75°; and in the greatest extremes seldom sinks or rises more than 5 degrees below or above that medium.*

* The mean temperature, from observations during eighteen years, has been given as follows:—January, 64°.18; Feb., 64°.3; March, 65°.8; April, 65°.5; May, 65°.53; June,

Although thus in the enjoyment of an almost continual spring, the island is singularly free from the annoyances and inconveniences that so commonly infest warm climates; and which go far, in fact, to overbalance all the luxury derivable from the temperature itself. Here are no periodical fevers; and, what is more remarkable, no snakes nor noxious reptiles of any kind; nor scarcely even a gnat.

Water, of excellent quality, is abundant. Springs are found everywhere, and copious; even the streams at the bottom of the ravines, fed by the mountain mists, are never dry in the hottest season; and the height from which they descend enables the inhabitants to divert the course of the water at any elevation or in any direction; the whole cultivated region, therefore, is irrigated on all sides by these *levadas*, or water-courses. On the coast, fish is abundant, and forms an important article in the food of all classes.

The only corn grown is bearded wheat and barley, and of this not more than is equal to two months' consumption in the year. That mostly imported is from the ports of the Baltic. *Milho*, or maize, is the principal food of the lower orders, and is imported chiefly from the Mediterranean. Timber and pipe-staves are from America.

The towns and villages are invariably situated on the sea-coast, and commonly at the outlet of a ravine; but where the bottom is fertile, and the surface permits, the cabins and *quintas*, or country seats, are often scattered up a considerable extent of the valley.

The population of the island, in 1826, was estimated at 102,000; according to the census of 1836, the ten divisions of the island contained a population of 115,447.

The revenue* of the island is stated to be about 210,000 dollars per annum. That portion which is derived from the customs is about one-half, or 110,000 dollars. The remainder is from taxes and tithes. The latter are now collected by the government, and from them the priesthood derive salaries. The inhabitants are liable to pay tax for the maintenance of the small naval force kept on the station. The expenses of the government of Madeira, including the support of the military garrison, are about 150,000 dollars, leaving a surplus to the government of about 50,000 or 60,000 dollars.

There are about 5,000 proprietors of the soil, of whom no more than 650 live on their rents; and there are about 400 who receive government salaries.

Mendicants are numerous, and one is much tormented with them from the very moment of landing. It is surprising to find them so importunate in so fine an island, and where the necessaries of life ought to abound.

" Wine is the staple commodity: the produce during the year 1837 was 14,150 pipes. The export of the year previous to our visit amounted to 8,435 pipes, of which about 3,800 pipes, valued at 793,000 dollars, went to the United States. The imports only amounted to 105,000 dollars, in staves, rice, and oil. The 5,700 pipes that remain, include that shipped to Europe, the home consumption, and what is stored for refining. The inhabitants of Madeira are much alive and justly jealous of the reputation of their wines, which are generally the engrossing topic of conversation. An amusing excitement existed during our visit. A London paper (the *Times*) had asserted that foreign wine had frequently been introduced into Madeira, and afterwards exported as the

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69°.74; July, 73°.45; Aug. 75°.2; Sept. 75°.76; Oct. 72°.5; Nov. 69°.8; Dec. 65°. The year is, therefore, one summer, with comparatively little alteration, either of temperature or hue.

" In fine weather,—and it is fine at Madeira nine months in the year,—the view of this steep and lofty island, covered with bright verdure, and enlivened by numerous scattered houses, as white as snow, is very striking to a stranger who arrives from the low and tame-looking shores of the South coast of England.

" Seamen are often deceived, when about to anchor in Funchal Roads, in consequence of the sudden transition which they have probably made from a low shelving coast to an abrupt and high mountain side; for the bottom of the anchorage slopes away as suddenly as the heights overlooking it, and the anchor must, indeed, be let go upon the side of a mountain. Hence ships seldom go close enough, unless guided by a person who knows the place; and many a chain cable ran out to the clinch, when chains were first used, owing to an incorrect estimate of the vessel's distance from shore, and not taking time to sound accurately.

" Closing the land quickly, after passing some time at sea—approaching high cliffs or hilly shores, after being, for a time, accustomed to low coasts—or nearing a flat shore, after the eye has been used to precipices and mountains—almost always is a cause of error in estimating distance, however experienced a seaman may be."—*Captain FitzRoy*, vol. ii. p. 46.

* *Narrative of the United States' Exploring Expedition*, vol. i. p. 17.

genuine article, to the United States in particular; and what gave more force to the story, it was stated as a fact, that 70 pipes had lately been entered, at the expense of 1,000 dollars, and manufactured. Everybody was up in arms. The commercial association passed resolutions denouncing the publication in strong terms, as designed by certain interested persons to injure the reputation of the wine of Madeira. So strict are the laws to prevent frauds, that even genuine Madeira, after being once shipped, cannot be returned to the island. I heard, however, of an attempt, and but one, to smuggle in Teneriffe and Fayal wines, which was discovered. The casks were broken, the wine destroyed, and the smuggler condemned to be transported to the coast of Africa."

The extreme length of the island is 31$\frac{7}{10}$ miles, its greatest breadth 12 miles, and the circuit along the line of coast 79 miles. The magnetic variation in 1843 was 24° 45′ W. High water, full and change, 12^h 48′; rise 7 feet: the flood runs *N.* 30° *E.* at 1½ miles per hour on springs.

FORA is the first land neared on approaching Madeira from the eastward. It is a small uneven islet, steep-to, and with rocky cliffs. A peak near its North end, 352 feet high, is in lat. 32° 3′ 14″, lon. 16° 39′ 30″ W. Off its S.E. side are some dangerous rocky patches, surrounded by deep water. The outer one lies S. 43° E. two-fifths of a mile from the peak, and is a small rock, with 4 fathoms on it; the inner one lies S. 34° E. three-tenths of a mile from the peak, and has several rocks, some with 15, and others with only 4½, feet on them. They should be cautiously rounded.

ST. LOURENZO POINT is formed by a rocky bluff, of small elevation; above the cliffs is a narrow ridge of hills, the highest being 348 feet above the sea. It is in reality an island, for at high water it is quite separated from Ponta Furada, and by the action of the sea may become permanently so.

PONTA FURADA is a bold, basaltic point, surmounted by a hill 550 feet high, and through it is a fine lofty arch, made by the waves. Half a mile West of it is *Ponta de Piedade*, crowned by a rocky hill, surmounted by a small but very conspicuous white chapel. North of this, quite across the narrow neck which forms the East extreme of Madeira, occur those curious fields of fossils, similar to those described at Porto Santo. *Caniçal Point* and village are 1¼ miles W. by S. of this, the coast being lower. To the S.W. of it the cliffs are bold and high, as far as *Machico Bay*, 1¾ miles S.W. of Caniçal.

MACHICO BAY is a most romantic spot, celebrated in tradition as the place where the first discoverer, Robert Machim, landed with Anna D'Arfet. The village church is supposed to cover their graves. The village has a considerable number of fishing-boats. Between Machico and *Ponta Queimada* the distance is half a mile, and thence to *Ponta de Santa Catarina* 1¼ miles; off the latter is a steep rock, but the whole coast is bold, and no outlying dangers. *Ponta Guindante* is the next projection; between them there is a bay, at the North end of which is the valley of *Santa Cruz*. Close around Guindante, to the S.W., is the village of *Porto Novo*, in a small shingle bay, where a considerable ribeira has its outlet.

Atalaya Point is nine-tenths of a mile *S.* 40° *W.* of Pta. Guindante, and has a singular small pointed peak on the cliff, close to it. From this *Ponta Oliveira* bears *S.* 51° *W.* 1 mile; it is a clean rocky point, steep-to, upon which you can land, and the ascent from it is easy.

CABO GARAJAO, the *Brazen Head*, the East point of the Bay of Funchal, is 1 mile S. 75° W. from Ponta Oliveira. It is a bold rocky headland, jutting out at right angles to the line of coast. It is formed by perpendicular cliffs of reddish-yellow tufa, and above them is a narrow hilly ridge of land, crowned with a rocky knob or knoll, 420 feet above the sea, on which is a telegraph. This knoll particularly distinguishes the head when seen from the westward. The cape is steep-to.

The BAY OF FUNCHAL is bounded to the East by the Brazen Head, and on the West by *Ponta da Cruz*, bearing from it *S.* 87° 40′ *W.*, distant 4$\frac{6}{10}$ miles. The coast to the West of Cape Garajao is a series of rocky cliffs and small stony points to Santiago Fort, which is exactly midway between the two extremes of the bay. It is also at the East end of the town of Funchal.

FUNCHAL, the capital of Madeira, was named thus by Gonçalves Zarco, on July 3rd, 1419, when first landed on, from the quantities of fennel growing here.

"Funchal," says Captain Wilkes, "has a very pleasing appearance from the sea, and its situation, in a kind of amphitheatre formed by the mountains, adds to its beauty.

The contrast of the white buildings and villas with the green mountains forms a picture, which is much heightened by the bold quadrangular Loo Rock, with its embattled summit, commanding the harbour in the foreground.

"The streets of the town are very narrow, without side-walks, and, to our view, like alleys; but their narrowness produces no inconvenience. They are well paved, and wheel carriages are unknown. The only vehicle, if so it may be called, is a sledge of some 6 feet in length, about 20 inches wide, and only 6 or 8 inches high, on which are transported the pipes of wine. Two strips of hard wood are fastened together for runners.

"This sledge is drawn by two very small oxen, and slips easily on the pavement, which is occasionally wet with a cloth. It is no doubt the best mode of transportation in Funchal for their wine, on account of the great steepness of their streets. Smaller burdens are transported on men's shoulders, or in hampers and baskets on the backs of donkeys.

"The middle gutters are now, for the most part, closed, and made subterranean, no longer the stranger's nuisance. Funchal may compare with most places for the cleanliness of its streets. Little improvement has as yet taken place in the cleanliness and discipline of its prisons."

The houses are commonly low, not often exceeding one story in height, and have generally an agreeable look of whiteness and neatness in the exterior. Those belonging to the *fidalgo*, or the richer merchants, are large and handsome. There is no public edifice of any consequence. The governor resides in the castle, a large, irregular, half-modernized mass of Gothic building, situated near the beach. All the houses have at the top a kind of *gazabo*, or belvedere, of more or less elevation above the rest of the building, which they call *torrinhas*, or turrets; and as the city is built on a rapid ascent from the shore, these lanterns always command a view of the harbour. The great object of resort to these turrets is to look out for vessels; the first thing to be done in the morning being to mount the turret, to see if any vessel had arrived in the offing in the course of the night. It is curious, says the writer, what a degree of accuracy, in the distinguishing of ships at a distance, is acquired by this habit of watching them. Every merchant's house has private signals, which are hoisted by the vessels respectively consigned to them; the destination, and even the name of which, is thus commonly known before they reach the bay.

The town of Funchal stretches along the margin of the bay for nearly a mile. The cathedral is a fine building: before its western door is a *parvis* or open space, and beyond that the *Terreiro da Se*, a very pleasant promenade, under four or five parallel rows of trees, and enclosed by a wall, a few feet in height. Some pretty houses are situated in the street on either hand, from the balconies of which the ladies look at the gentlemen below. Beyond the Terreiro is the market-place, which is very clean, and regularly laid out in streets and stalls: the latter roofed.

The church of *Nossa Senhora do Monte* is the neatest in the island. It is seated on a terrace just halfway up the mountain, and commands one of the most enchanting views in the world. The *quintas*, or country residences, of the English merchants are delightful, and it is pleasant to spend a Maderian afternoon in riding about, with good company, from one to another. The English church, on the skirt of the town, is an elegant and convenient building, literally embosomed in ever-springing roses and white daturas.

The *Corral* or *Curral* of Madeira, a few miles north-westward from Funchal, is one of the grandest scenes in the world. It is finely described in the volume, entitled *Six Months in the West Indies in* 1825. A friend who had visited Switzerland said, that in the Alpine country he had never seen anything so wonderfully sublime as this place. It is a huge valley, or rather crater, of immense depth, enclosed on all sides by a range of magnificent mountain precipices, the sides and summit of which are broken into every variety of buttress or pinnacle,—now black, and craggy, and beetling,—at other parts spread with the richest green turf, and scattered with a profusion of the ever-green forest trees, indigenous to the island; while far below smiles a fair region of cultivation and fruitfulness, with a church and village, the white cabins of which seem half smothered in the luxuriance of their own vines and orchards.*

* Captain W. F. Owen says, that the *Curral* means simply a sheepfold, and is an immense valley, completely surrounded by hills, whose sides are literally perpendicular, in no part being less than 1,000 feet high. Round a part of these cliffs is a narrow road, leading to the garden houses and country plantations, cut out of the rock, about 10 or 12 feet wide. On riding along the road over the Curral, it seems like an unfathomable abyss, filled only by clouds and vapours rolling in a constant motion over each other.—*Voyage*, vol. i. p. 11.

Although MADEIRA is so elevated, excepting the eastern end, which is a low, rugged point, yet it is often so entirely clouded over, as not to be visible at the distance of 5 leagues. But, when abreast of Porto Santo, the island commonly appears as one great mountain, with its summit hidden in the clouds. Shortly after appear the Desertas. Having passed those islands, you will soon perceive the ships in the Road of Funchal; and, from their riding, it will be seen how the wind is in the road, as it is common to have a strong breeze from the N.E. or East, on passing the Desertas, when, at the same time, the wind in the road is from the S.W. or W.S.W.

When sailing in toward Funchal Road, a large rock, named the Loo Rock, with a fort on it, will be seen on the West side of the road, a little to the westward of the town. With this rock N. by E., when in 38 or 36 fathoms, let go the larboard anchor, with two cables on it; for, should there be a fresh breeze from the eastward, it will be scarcely possible to bring up, until the splice is veered a good way out. It is requisite to ride in the road with a whole cable, and with a splice so situated, that you may be able to cut near it, should circumstances unfortunately compel you to put to sea, without weighing anchor. While riding, keep a slip-buoy on the cable, have a kedge-anchor and a nine-inch hawser to the westward, to keep the ship steady, with the hawser on the starboard bow, as the wind generally veers from the eastward to S.W. and West. When the land-wind makes a cross, the end of the hawser may be shifted.

The general anchorage is from 30 to 35 fathoms, with the cidadel (called the *Peak Castle*, a brown square fort on a hill over the N.W. part of the town) a little open to the eastward of the Loo Rock; the latter at the distance of half a mile.

With the Loo Rock and citadel in one, bearing nearly N.N.E. ¼ E., and Funchal Steeple N.E. ¼ N., the anchorage appears equally good, in 35 fathoms, stiff ground. With the same marks, with the Loo about a mile off, there is good ground in 45 fathoms. To the westward, the ground changes to sand and rock, and to the eastward it has a sudden declivity from 50 to 55 fathoms, stiff clay ground, to 100 fathoms, rock, and then no ground.*

In case of a S.W. gale, which may be frequently expected in winter, the situation with the Loo and citadel in one, or the citadel just open to the westward of the Loo, will be found most convenient. On the contrary, the citadel well open to the eastward of the Loo is the best situation when a south-easter may be expected.

When coming into the road, with a brisk wind, sail should be reduced and secured in time, to prevent having too much way through the water, at the moment of anchoring; and ships should be brought up with their heads to seaward; for thus, in case of any accident in bringing up, sails may be had off shore, or otherwise, as required.

Mr. Finlaison, who wrote his remarks in 1821, has said, "It is generally reckoned the best anchorage for ships with the Brazen Head E. by S., Point de Cruz, W. by N., Loo Castle, N.E.: but I would recommend ships to anchor at a good quarter of a mile to the westward of these bearings; as I am convinced that here is better holding ground, and

* COALS.—*Steam-vessels* may very readily procure coals at Funchal. In 1845 it was announced that Mr. James Taylor, merchant, supplied all steam vessels, H.M. ships included, with the best steam coal with the utmost possible dispatch, at Funchal. A white flag, with St. George's cross, indicates the coal store on the beach, and steam-vessels intending to coal should bring up as near to it as possible. The flag is always hoisted over the coal store adjoining Banger's Pillar when coaling from the beach is practicable. No signal is hoisted at the coal store when the surf on the beach prevents coaling in the regular way; in such cases coals will be shipped from the Pontinha behind the Loo Rock.

The bearings recommended for steamers requiring to coal from the beach store to bring up are, the Loo Rock and western land locking, bearing W. by N. ½ N., *mag.*, and the old pillar on the beach in one with the *square* church tower, N. by E. ¾ E.; distance from the beach, one quarter of a mile; depth of water, 14 fathoms; bottom, mud. If to coal from colliers, a short distance to leeward of them, and the coal boats will drop down with their loads. If to coal from the Pontinha, when there is too much sea with westerly winds, the mount church in one with cathedral tower; Loo Rock W. by N., keeping the extreme of the land to the westward open to the South of it, one-quarter mile off the Loo Rock, in 10 fathoms, sandy bottom.

A wheft hoisted at the fore indicates order to send off coals. This, when shown by steamers in sight of the port, will bring coals alongside as soon as they anchor. Collier ships, when desiring to coal from them, will hoist it at the fore. Proper boats, with able, active men, coaling bags, &c., in constant readiness to ensure despatch, and put on board 120 to 160 tons of *coals per day*. All the coals are stored under cover to prevent their deterioration.

clear of anchors. Ships should not anchor farther to the eastward than to bring the high fort [Peak Castle] on the *West* end of Loo Castle. With the fort open to the eastward of Loo Castle, the ground is rocky, and has in it many anchors.

"*Those riding in Funchal Roads* should be very active when they observe a swell coming in from the S.W.; at this moment, no time is to be lost in getting under way, for the swell indicates that a gale is certainly coming on; particularly so in the months of December and January, generally the commencement of the rainy season. Should it come on to blow very hard from the westward, the best mode is to run to leeward of the Desertas, where shelter from the wind may be found, and water perfectly smooth: thus you avoid the risk of losing sails, by heaving to windward."*

Off the valley of Funchal there are regular land and sea-breezes, particularly during the summer; the sea-breeze sets in from the south-westward some time in the forenoon; the land-breeze sets off shore about ten o'clock at night, sometimes later, even to two or three o'clock in the morning: these breezes do not extend above 3 or 4 miles off shore; but, when it blows fresh in the offing, there is generally a counter breeze in the stream of the valley of Funchal; unless it blows hard, when the true wind prevails also in the road.

There is generally a surf on the beach, early in the year particularly, which prevents landing in a ship's boat anywhere, except within (to the north-westward of) the Loo Rock, about half a mile from the town; therefore, the boats of that place are employed for goods, watering, &c. The tides rise and fall about 7½ feet; and the current along the South side of the island seems to be always governed by the true wind in the offing. The rainy season is in January, February, and March; October is also frequently a wet month, as well as November and December.

The road is open from the West to the S.S.E. The winds blow strongest here when from S.W. to S.E. Ships anchoring in the road in winter must be guarded against the consequence of a dark gloomy appearance of the atmosphere to the southward, with a swell setting in; for it is very dangerous to remain at anchor with these prognostics.

Squalls sometimes come fresh off the land; there is one instance of a hurricane, down the valley of Funchal, blowing every ship out of the road, which was so violent, that the ships were hid from the town by the spray of the sea, although in a clear sun-shining day.

The best way for ships, however large and numerous, when bound into Funchal Road from the eastward, with the wind north-easterly, is through the passage between the Desertas and Madeira. The north-easter will carry them to the offing of the Brazen Head, the East point of the Bay of Funchal. In the night, a single ship may keep over toward that bluff point, and, with her boats towing ahead, when becalmed, luff up into the stream of the land-wind, and by that means fetch the anchorage. Ships must show a light at their ensign-staff in the night, to prevent being fired at from the forts at Loo Castle. In the day, they should keep farther distant from the land than in the night, to avoid being becalmed under it, and to gain the stream of the sea-breeze. If, from over-

* Some of the old inhabitants affirm that there is no danger in attempting to ride out a gale from the southward, as it rarely continues long. It is said that no vessels with good ground tackle have ever been lost by pursuing this method, and that many, in attempting to get away at the commencement of the gale, have been driven on shore.—*Voyage of the Chanticleer*, vol. i. p. 10.

Captain FitzRoy says, "The roadstead of Funchal is well known to be unsafe in S.W. gales; and there can be no doubt, that the most prudent plan is to keep at sea while they last; but I have been told. by old traders to Madeira, that ships sometimes remain at anchor, about half a mile from the Loo Rock, and ride out S.W. gales without difficulty; the under-tow being so considerable, that their cables are little strained."—Vol. ii. p. 46.

These statements require some modification. On October 15, 1842, Madeira was visited by one of the most dreadful storms that had occurred since the flood of 1803, which swept 400 persons into the sea. Although fewer lives were lost, the destruction was awful; a deluge of rain commenced on the day above mentioned, and continued without intermission for nine days. On the 24th the whole island appeared to be buried under a vast cloud, threatening total darkness. At one o'clock an immense rising in the sea appeared in the bay, which, rushing onwards, overwhelmed the lower parts of the city of Funchal, already deluged with the rushing torrents from the ravines, and on its return washing away upwards of 200 houses. On the 26th it blew a tremendous hurricane from the South, which, with the terrific sea, drove four out of the six vessels at anchor on shore, with total destruction, and nearly all the crews were lost.

caution, or other reasons, they fall 2 or 3 leagues to the leeward of the road, they should then keep plying up in the stream of the valley, until they gain the vein of the sea-breeze. In working in with a land-breeze, it is best to make short tacks, opposite the valley; as here both the land and sea breezes are most regular.*

Small vessels, from North America and the Western Islands, come in, generally, round the West end of the island, but are frequently becalmed a considerable time under the high land there. From this reason ships, on leaving Funchal, should make sail with the land-wind, and stand directly off from the road; ships bound to the southward, by taking a contrary method, having continued several days becalmed under the western part of the island.

In the winter months eddy-winds and squalls, proceeding from the high land, are frequent and severe, and the ships are often forced to put to sea from the road. Several westerly and S.W. gales, with rain, then frequently prevail, and prevent regaining it for some time. At these periods, Madeira and the Desertas are often obscured in fog. The squalls have been found so sudden and violent near the Desertas and about the S.E. end of Madeira, as nearly to overset the ships in the vicinity; and many have been driven by them far to the eastward.

With a gale at S.W., and a high sea rising off the S.W. end of Madeira, a ship, in November, 1797, bore away to find shelter under the lee of the island; the weather dark with rain. Between Madeira and the Desertas the ship was suddenly becalmed; then followed an eddy-wind from N.E., and the sea frequently over the bowsprit and jib-boom. A dark cloud was now overhead, and the ship near the land of Madeira. At this time two ships were seen 2 or 3 miles to the eastward, in clear sunshine, running before a sharp squall at S.W.

It has been said, that a southerly wind never blows hard quite home to Funchal; that the south-westers and south-easters are never expected, except in January, February, and the beginning of March; and that large ships almost always ride them out; but Captain Horsburgh has stated, that "these southerly gales sometimes blow quite home to Funchal, even in November and December: and, when they are apprehended, it is common for ships of every description to put to sea. These S.W. or S.E. gales are, in general, preceded by a swell in the road, often accompanied by gloomy weather, drizzling rain, and a very unsettled breeze from the land, veering backward and forward very suddenly. Under such indications, ships generally proceed to sea:" for, should it blow strong from the southward, it would be almost impossible to clear the shore, the anchorage being so close to the land. A few years ago, several vessels were driven from the anchorage, and completely wrecked on shore.

The regulations of the Port of Funchal require all ships, before, or immediately on, anchoring, to acquaint the governor of the island what they are, and their reasons for stopping there. Ships of war are not to send their boats to vessels coming into the road, until they are visited by the pratique-boat, a boat manned by persons appointed to inquire if any infectious disorder is on board. The same is to be observed respecting vessels that are departing, which are not to be boarded after the visiting officer has been to search for natives attempting to leave the island clandestinely, and for prohibited goods. English ships of war salute with thirteen guns, after an assurance of an equal return.

The boats may land on the beach in summer: but they are driven by a violent surge on the shore, which is shingly. The landing at the steps of the Pontinha, near the Loo Rock, before mentioned, is safe and easy, being defended from the surge.

It is necessary to be cautious of the shore-boats, which will come to the ship to sell

* Admiral Mackellar says, in his journal, "Of Funchal Roads, I shall only observe, that in running for the island it is necessary to give the North end sufficient room; so as, by nearing the land too much, you may not be becalmed, and thereby drift to leeward of the roads, observing to open out the anchorage well before you haul in; and, if possible, drop anchor to the southward of the Loo Rock, in about 30 or 35 fathoms, nearly off the centre of the town; but frigates and smaller vessels may go close in-shore, and anchor in 20 or 25 fathoms. My reason for choosing this anchorage is, that there is a truer land-wind to get under way with, and a better drift, should you bring your anchor home; which, from the steepness of the bank, and the badness of the ground, often happens.

"In leaving Madeira, you should do it during the night, or early in the morning, as then the land-wind blows right off, and you drift to sea, without risk, giving you time thereby to stow your anchors, and clear the land before the sea-breeze sets in."

fish, fruits, and vegetables, as their chief object is often the sale of the worst spirituous liquors to the seamen, and sometimes concealed goods. Fresh beef, water, and vegetables, are to be procured here for the ship's company, and are sent on board in boats belonging to the place.*

* The PORT REGULATIONS are as follow:—On anchoring at *Funchal Roads*, no vessel can have communication with the shore, or the shipping in port, until visited by a flag-boat from the government, or from the Health Office. But in case of distress, when a vessel does not intend to anchor, and wants to have communication with the shore, her boat, by proceeding to the *Loo Castle*, will avoid being fired at; and after examination, leave is generally given for the officer in her to go into town, and return to the ship without any embarrassment.

The master, purser, or other persons coming in the first boat from any vessel regularly visited, must land at the Health Office, there to undergo the customary examination; and the captain or purser should proceed immediately to the Consul's Office, to report the ship; passengers are free from restraint after passing the Health Office.

Captains or pursers, so landing, must bring with them the vessel's Register and Mediterranean Pass, and also the manifest of her cargo, as, without these documents, business cannot be transacted at the consular and other offices.

No vessel lying in port can have any communication with one that is coming in, or that has already anchored, until such new comer shall have been regularly visited.

No vessel at anchor can change her berth without licence from the government.

All boats that pass between the shipping and the shore, after sunset, are subject to pay a pistareen and a half for a government licence.

No seaman or soldier to leave their ships without permission in writing from the captain or commanding officer.

Any seaman or soldier found on shore, after sunset, without written leave of absence, is liable to be taken up by the government, and kept in custody until claimed and sent on board ship; which will, exclusive of his maintenance, occasion an expense of two dollars for each individual, to be deducted out of his wages; and even with leave, as above, any disorderly conduct is immediately taken notice of by the government, and punished accordingly.

All captains or commanding officers are requested to read the above two articles to the sailors and soldiers on board their ships, as particularly relating to them.

Captains or pursers must give notice at the Consul's Office, twenty-four hours, at least, before the time of their intended departure.

No vessel is to carry from Madeira any person or persons, excepting those that came in her, *without a regular passport*; as, in case of detection in attempting to do so, the master is liable to a fine of 100 dollars, and to three months' imprisonment.

In cases where the captain of a vessel shall be judicially notified not to carry away any particular person from the island, and he does receive him on board, notwithstanding such judicial warnings, he becomes liable for all the debts which such person owes.

When vessels are ready to depart, the captain must, through the consul, or their consignees, apply to the government to have its visit sent on board at the hour when they will be ready to proceed to sea.

After a vessel has been visited for the purpose of proceeding on her voyage, and circumstances require her to have communication with the shore, or the shipping in port, she cannot sail until visited a second time.

No vessel can sail after sunset, without special licence; and in case a ship is visited for departure, and finds she is obliged to remain a night after, she must not attempt to sail until visited a second time.

As vessels are frequently fired at from *Loo Castle* for attempting to anchor at night, it is recommended to those who make the port too late in the evening to have their colours seen, to stand off and on till daylight, when the restriction ceases; indeed, at all times, it is as well to hoist the colours and merchant's signal as early as possible, for the information of the consignees on shore.

Any vessel attempting to get under way, before she is visited, will be fired at from the forts, and will be obliged to pay very dearly for the powder and shot. This must also be understood in not observing any of the foregoing rules.

No commander of a vessel can leave any of his crew behind him, excepting in the hospital, without first giving security in the Consul's Office for their subsistence.

As the greatest attention is necessary on the part of masters of vessels for the benefit of the concerned, it will be found much to the interest of all parties, that they by no means sleep on shore; a caution of this kind is doubly necessary in the winter.

It is necessary that the captains and supercargoes should be acquainted, that in case of breakage in the measurement of corn, after allowing 2½ per cent., the vessel must make up the deficiency at the market price at Madeira, according to the long-established regulation at the British factory.

The *Loo Castle* usually fires two guns, without shot, on any vessel's breaking the rules of

From the Pontinha to *Ponta da Cruz* the distance is 1¼ miles; the coast between has a broken outline of rocky cliffs, points, and bays. The bay to the West of the Pontinha is half a mile across, and its shores are composed of steep cliffs, with a high bold bluff at its West extreme. Along the base is a beach of sand extending as far as the watercourse. The whole of the bay is comparatively shallow, and appears to offer the best position in Madeira for any artificial harbour works.

The *Gorgulho*, a detached sugar-loaf formed rock, lies off a pretty little bay, half a mile West of this. Four-tenths of a mile North of this rock is *Monte da Cruz*, 862 feet high, with a telegraph on its summit, and hence there is a succession of rocky cliffs for another half mile to *Ponta da Cruz*, at the S.W. extremity of which there is a semi-detached pointed rock with a small iron cross on the top of it. This rock is the South extremity of Madeira, and is in lat. 32° 17′ 18″ N., lon. 16° 57′ 11″ W.

Immediately to the West of Ponta da Cruz is the little bay of *Praya Formosa*, formed by a shingle beach; and at 1¼ miles from it is the mouth of the *Socorridos River*, a mountain stream, perhaps the largest in Madeira, which drains the celebrated valley of the Curral. At the West side of the mouth of this is a small bold rocky part, round which are the village and little boat harbour of *Camera de Lobos*. The West side of this is a narrow wavy line of black lava, running out South for 270 yards. The little town is old and poor enough, but the sides of the mountains around are covered with quintas and vineyards, and are said to form one of the finest wine districts of the island.

Cape Girao, a magnificent headland, is 3¼ miles West of Ponta da Cruz. It is the termination of a ridge of mountains lying westward of the valley of the *Jardim da Serra*. The cape is nearly perpendicular for 1,600 feet above the sea, which nearly washes its base; and upon the high land which covers it is a grove of pine trees, 2 079 feet above the sea. The hills continue rising until they reach the head of the valley, at an elevation of 4,535 feet.

At 2 miles from Cape Girao is the *Ilheo de Lapa*, a conical shaped rock, in front of the village of Campanaris. The coast to the East has a continuous line of stony beach; towards the West this characteristic alternates with *clean* black rocky points.

Ponta do Sol is 5¼ miles W.N.W. of Cape Girao. It is a bluff rocky cliff, with some fragments of rock lying close in front of it; the largest of these is pointed, and has a small wooden cross on it. The Ponta do Sol in a westerly gale and stormy weather appears surrounded with the colours of the rainbow, arising doubtless from the spray of the surf; hence, probably, its name has been derived. The village of Ponta do Sol is up the ravine to the West of the point; its church may be seen through the narrow gorge. Westward of this the coast is a long wavy line of narrow stony beaches, above which are cliffs of small elevation, much broken by ravines and land-slips: one remarkable piece of cliff stands 1¼ miles West of Ponta do Sol. Three-fourths of a mile beyond this is the village of Magdalena, at the outlet of a ribeira; 2 miles beyond Magdalena is another ribeira; the space between is called the *Arco da Calheta*. At 5 miles from Ponta do Sol is the town of *Calheta*, but little can be seen of it through the very narrow ravine. At a quarter of a mile West of it, above the cliffs, on a ridge of land, is a conspicuous long building like a monastery. *Ponta Galera* is seven-tenths of a mile from Calheta; it is a natural jetty of flat rocks of black basalt, 100 yards long.

Ponta Jardim is 1⅓ miles *N.W. by W.* of Ponta Galera; it appears to be a land-slip; upon the top of it are a small village and a chapel. The soundings off this part of the coast are regular, over dark sand, and extend off 1¾ miles, with 30 fathoms 1 mile off. *Paul do Mar*, a village on the coast, is 1 mile from Ponta Jardim. There is a waterfall here, and a great land-slip. The land is cultivated in terraced vineyards. A grove of pines above Paul do Mar is 2,030 feet (or one-third of a mile) above the sea, while its horizontal distance from it does not exceed half a mile. This will give an idea of the bold character of the scenery.

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the port; if those are attended to, in general they take no more notice; if not, not only the *Loo*, but the other forts, fire with ball, till their object is obtained.

As many inconveniences arise from not observing the foregoing regulations, every commander of a vessel will find it to his interest to attend to them, as otherwise he will forfeit the protection of his consul, and find the consequences in the highest degree disagreeable.

To avoid considerable delay and expense, it is absolutely necessary to have a bill of health endorsed by the Portuguese consul, or vice-consul, of the last port of clearance.

The beach of shingle and large stones extends 1⁷⁄₁₀ miles to *Point Fajao d'Ovelha*. Here it is broken through by a little spur of black lava; the cliffs become more elevated, and above them the land rises with a steep ascent to the highest peaks of the western mountains, 4,270 feet.

PONTA PARGA is the western extremity of Madeira, and is 2¾ miles W.N.W. of Ponta Fajao d'Ovelha. The bold rocky cliffs of the point are 935 feet high, and the smooth topped hill to the East is 1,380 feet. On the heights, 1 mile East of the point, there is a church. Some rocks and large stones lie scattered around the base of Ponta Parga, and a rocky ridge of 11 to 20 fathoms runs off it 1½ miles, and occasions a heavy sea in westerly winds. Ponta Parga is in lat. 32° 48′ 6″ N., lon. 17° 16′ 38″ W.

The bank of soundings extends 5¼ miles West of Fajao d'Ovelha Point; to the N.W. of Ponta Parga its breadth is 2¾ miles. It is flat, with 40 to 46 fathoms, light brown or a dark gray sand, and occasionally rock. From these depths it drops very suddenly to 200 fathoms.

PONTA TRISTAO is the next point, N.E. of Ponta Pargo, bearing *N.E.* 5 miles. The coast between is a wavy line of coarse stony beach, with high rocky cliffs rising abruptly from it. Above the cliffs the land rises steeply to the ridge of mountains above 4,000 feet high, and 2 miles from the shore. Ponta Tristao, the North point of Madeira, is a high, bold bluff, 1,070 feet high, off the foot of which are a few sunken rocks extending 130 yards, but clear beyond. On the heights, 1 mile to the South, is the parish church of Magdalena, 1,709 feet above the sea. At nine-tenths of a mile *N.* 60° *E.* from the point, and about half a mile from the adjacent beach, is a singular cluster of flat rocks, a few feet above the sea, called the *Rochas de Rabaçal*. With any sea, the surf rolls over them, but they are steep-to, and a deep channel inside them.

Ponta Moniz is 1¼ miles from Ponta Tristao, and is formed by a mass of lava running out N.E. about 470 yards beyond the general line of coast, and looks as if it had flowed over and beyond the cliffs into the sea. The shores of the point have a very irregular and broken outline. On either side of it are detached rocks, and right off the bluff are four others in a straight line. On the East side of the point is a small fort with a round tower; and 140 yards S.W. of the outer islet off the point is another rocky point and another round tower, at which is the best landing as at a jetty. The town of *Moniz* is on the higher part of the point; the chapel being one-third of a mile from the landing-place. The whole point is cultivated with vines. In front of the point, at the distance of 120 yards, is an islet of the same name, composed of yellow tufa resting on black lava. Its shores are precipitous, and it is the resort of sea-fowl; it has no channel inside it. The little bay, locally called *Porto Moniz*, is in fact a rocky bank, varying in depth from 2 to 10 fathoms.

One mile *S.* 42° *E.* from Ponta Moniz are a group of rocks called the *Janellas*, lying near the outlet of that ribeira. They are five in number, the largest 133 feet in height. At 2¾ miles *S.* 52° *E.* from the outer Janella is the point and village of *Sieçal*. The point is a comparatively low rocky projecting piece of land, with a great variety of feature. The town stands on the top of the point, a short distance from the cliffs, and surrounded by vineyards. The best landing is on the largest rock at the East extremity of the point, which is on this account connected with the shore by a wooden bridge.

San Vincente is 3¼ miles from Ponta Sieçal. The outlet of the ribeira is marked by an isolated sugar-loaf rock, standing a few yards within the beach. This rock has been excavated and converted into a chapel. *Ponta Delgada* is 3¼ miles from San Vincente, the coast between being generally similar to that West of the latter, a piece of low land at the foot of the mountains, with houses and cultivated enclosures. Ponta del Gada is a comparatively low point, composed of rocky cliffs, with a tower upon the top of it. The houses, which are numerous, and many of them pleasing and respectable, are scattered thickly among the richly cultivated vines and orchards, with a very pleasing effect. The church, large and handsome, is close to the sea. Close round the point, on its East side, is a small bay, with a little bit of fine shingle in it, which offers the best landing.

Ponta do Arco, a bold black point, is 1¾ miles East of Ponta del Gada. Nearly mid-way are a few large detached rocks, the largest called *Rocha de Boa Ventura*. A group of low rocks lie off 230 yards to the W.N.W. of it, and abreast of it are two *ribeiras*, the larger named *Entroza*. Nearly three-quarters of a mile inland from Ponta do Arco is a conspicuous sharp wooded peak, 2,746 feet high, the summit of the Arco de San Jorge, which proved a valuable station in the survey from its unmistakable peculiarity of feature.

PONTA DE SAN JORGE is in lat. 32° 39′ 44″ N., lon. 16° 54′ 47″ W. It is a high, bold, rocky bluff, nearly 700 feet above the sea, and may be called the N.E. point of the island. A small low rock just seen above water, on which the sea commonly breaks, lies *E.* ½ *S.* three-tenths of a mile from Ponta San Jorge. The next point to the S.E. is *Santa Anna*, bearing *S.* 59° *E.*, distant 1$\frac{1}{10}$ miles. On the same bearing is a large isolated rock, *Ilheo de San Jorge*, 134 feet in height, one-third of a mile from Santa Anna Point. The point is formed by a gradually rounding narrow beach of large stones and coarse shingle, from which the land rises very abruptly. One-fourth of a mile from the sea it attains an elevation of 1,100 feet. The country above the sea face is well wooded and extremely beautiful; and the quintas spread over it are amongst the most favourite summer retreats of this island. A detached rock lies a quarter of a mile S.E. of the point, and is about 12 or 14 feet high. At 1½ miles from this point, and 400 yards off shore, is a small isolated rock, which uncovers at low water.

Ponta Cortada, a remarkable point, is 1$\frac{6}{10}$ miles *S.* 52° *E.* from Ponta de Sta. Anna; at six-tenths of a mile to the N.W. of it there is a singular sharp peak, 1,730 feet high, standing close to the edge of the cliff overlooking a large high mass of rock at its base, called the *Rocha do Navio*. Ponta Cortada has a very sharp termination, with a peak above the cliff, and deep water close up to it.

Ponta de Fayal, the next point, is comparatively low and narrow, and has a perpendicular rocky cliff extending from its outer extreme along its N.W. side. Outside the point, bearing *N.* 49° *S.* one-third of a mile off, is a black basaltic rock, called the *Ilheo de Fayal*, with a sugar-loaf rock in its centre, 74 feet high. A quarter of a mile S.E. of the point there is a sharp bold rocky spar. The small town of *Fayal* lies up the bay between them. The cliffs from which this spar projects rise to a considerable elevation, and form the sea face of a singular flat-topped mountain, named *Penha d'Aguia*, or *Eagles' Rock*, whose summit is 1,915 feet high.

Ponta da Cruz is the outer extreme of a small peninsula, 1$\frac{6}{10}$ miles S.E. of Ponta de Fayal. It is surrounded by low rocky cliffs, and in front of it there are four detached rocks, the outer one of which is 500 yards off the point. To the S.E. of the point is a bay, three-quarters of a mile across, called *Porto da Cruz*. It has a shingle beach at its head, and here is also the little town of *Santa Cruz*. The coast beyond consists of bold rocky cliffs, of no great elevation at the sea, but the land rises above them precipitously. The last habitation seen on this part of the island was close to the coast, half a mile beyond Ponta da Cruz.

Ponta de San Antonio is 1$\frac{6}{10}$ miles to the E.S.E., and is a bold rocky point. Two rocks lie close at the foot of it, and half a mile inland is a mountain, 2,510 feet high, densely covered with trees. A dreary iron-bound coast, without inhabitants, extends for 5¼ miles to *Ponta do Castello*, the cliffs of which are of a reddish tufa, 534 feet high, bold and perpendicular. At the foot of the bluff, 100 yards off, is a breaking rock. The shore throughout is broken into innumerable small coves and bold fantastic points, with a great variety of detached rocks, but in no case beyond 250 yards from the shore. A mile and three-fourths from Ponta de San Antonio, and about six-tenths of a mile inland, is a high green woody peak, named *Castanhas*, 2,058 feet above the sea. The land East of it has a steep descent to Caniçal. Three miles and a half to the East is *Ponta Bode*, a bluff, with a bay on each side of it. One mile and a half farther is *Ponta Rosto*, with a group of rocks off it. There are other rocks off this point which need not here be particularized.

The bank of sounding extends farther off this part of the coast than any other, except Ponta Pargo, and the depths over it are tolerably regular, except in front of Ponta da Cruz. Its breadth hereabout is from 2¼ to 3 miles, and the depth from 20 to 80 fathoms, the bottom generally of dark gray sand, and occasionally with coral.

We have extracted many of these particulars from the excellent and detailed account given by Captain Alexander T. E. Vidal, R.N., the Admiralty surveyor, as given in the "Nautical Magazine" for 1848.

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5. THE CANARIES, OR CANARY ISLANDS.

THIS group of islands, supposed to be known to the ancients under the name of the FORTUNATE ISLANDS, was neglected by the moderns until the year 1402, when Jean de Béthencourt, a baron of Normandy, took possession of Fortaventura and Lanzarote, for

John, King of Castile. By the treaty of peace between Ferdinand, King of Castile, and Alphonso, King of Portugal, it was agreed that these islands should belong to Spain, in lieu of the settlements on the continent of Africa, ceded to Portugal.*

PRIVILEGED PORTS OF THE CANARIES.—By an official notification, dated 9th February, 1838,—"The Port of *Santa Cruz*, in the Island of Tenerife, was declared a custom-house port of the first class,—that is, open for commerce of every description, national and foreign; and also to have the privilege of a port of deposit of the first class. The Port *Orotava*, in Tenerife, and the Port of *Las Palmas*, in the Island of Canary, are declared custom-house ports of the second class, open for commerce of every description, national and foreign, with the privileges of ports of deposit of the like class. The *Puerto de Lau* (?) in the Island of Palma, and the Port of *Arricife* (or *Recife*), in the Island of Lanzarote, are declared custom-house ports of the third class, open for the exportation of the productions of the country, of all kinds, and for any other kind of merchandise, with cockets from the custom-houses of the first and second class. The Port of *Cabrasia* [Cabras], in the Island of Fuertaventura, the Port of St. Sebastian, in the Island of Gomera, and the Port of Golfo, in the Island of Ferro, are declared custom-house ports of the fourth class, open for the exportation of the productions of the country, of all kinds.

"Every vessel, Spanish or foreign, that may arrive in the ports of the Canary Islands *in transitu*, that is, with the sole object of taking in water or refreshments, or repairing damages, shall not be subject to any charges, except fees for the health-visit, and those for the captain of the port; the captains of such vessels being allowed (if in want of money to pay for the same) to sell part of their cargo for that special purpose, the vessel being still treated as *in transitu*, and the effects sold and purchased being subject to the duties imposed by the tariff.

"N.B. The difference between the first and second classes of ports of deposit is, that the former are open to the produce (if not especially prohibited) of all countries, whilst the latter are confined to national produce exclusively."

DESCRIPTION, &c.—The land of the Canary Islands is generally high, being variegated by volcanic mountains, among which that called the Pic, or Peak, of Tenerife, is supereminent. The inequality of height is, however, so great as to produce differences in the temperature of the different islands. For eight months in the year the summits, excepting those of Lanzarote and Fortaventura, are covered with snow; yet in the valleys, and on the shores, the cold is seldom so great as to render fires necessary. A great proportion of the surface of the islands is covered with lava, calcined stones, and ashes, formerly emitted by volcanoes, the remains of which are still visible in all the islands; and some of them, among which is the Peak of Tenerife, are not yet entirely extinguished. The number of inhabitants is computed at 200,000. The productions, exports, and imports, may be found correctly described in most geographic works. The first discoverers found neither corn nor wine; though, at present, there is plenty of both.† Variation of the compass, 20¼° West.

Vessels may pass between the Canaries, and through their principal channels; as there is no known danger but what may be plainly discerned, excepting a sunken rock, laid down in some charts, in the southern part of the channel, between Tenerife in the Grand Canary, about 8 leagues E.S.E. of the South point of Tenerife, and 4 leagues westward of the centre of Canary.

In sailing from Funchal to Tenerife keep well to the westward, steering S. by W. ¾ W. [*nearly South*] in order to avoid the *Salvages*, which are very dangerous in the night.

If prevented from weathering the Salvages or the Piton (described hereafter) by prevalent westerly and S.W. winds, common in the months of January and February, when

* ALLEGRANZA (the northern isle) is synonymous with *joyous*, a name given it by the first conquerors of the islands, Jean de Béthencourt, and Gadife de Salle. This was the first point on which they landed. After remaining several days at Graciosa, they conceived the project of taking possession of the neighbouring isle of Lanzarote, where they were welcomed by *Guadarfia*, sovereign of the Guanches, with the same hospitality that Cortes found in the palace of Montezuma. The shepherd king, who had no other riches than his goats, became the *victim of coward treachery*, like the sovereign of Mexico!—*Humboldt*.

† For the atmospheric changes of the barometer at the Canary Islands, see the Appendix hereafter.

a heavy swell may set the ship much to leeward, you may safely bear up and run to leeward of the Great Salvage; only observing that, if the swell be very heavy, you must cautiously avoid three shoal spots, lying to the northward and eastward of that isle. Of these, the northern one is about three-quarters of a mile to the northward [*N.N.W.*] of the isle; the inner one on the N.E., 250 fathoms from it; and the outer, in the same direction, $1\frac{1}{10}$ miles. Two others, with 3 and $3\frac{1}{2}$ fathoms, lie at about half a mile from the eastern shore.

The SALVAGES consist of an island, named *Ilha Grande*, or the *Great Salvage*, a larger islet named the *Great Piton*, and a smaller one called the *Little Piton*, together with numerous rocks. The *Great Salvage* lies in lat. 30° 8′, lon. 15° 55′. It is of very irregular shape, and has a number of rocks about it within the distance of a mile.

The Great Piton lies at the distance of $8\frac{1}{4}$ miles W.S.W. $\frac{3}{4}$ W. [*S.W. by W.*] from Ilha Grande. This isle is $2\frac{3}{4}$ miles long, N.E. $\frac{3}{4}$ E. and S.W. $\frac{3}{4}$ W. [*N.E. by N. and S.W. by S.*] and has a hill or peak near its centre. The *Little Piton* lies at a mile from the western side of the former, and is three-quarters of a mile long, nearly in the same direction; both are comparatively narrow. These isles are seated upon, and surrounded by, one dangerous rocky bank, which extends from the western side of the little isle half a league to the westward.

It has been said of the Great Piton, that, in some respects, it resembles the largest Needle Rock at the West end of the Isle of Wight; and, at a great distance, looks like a sail. Its southern part appears green, its northern part barren. It may be seen 5 or 6 leagues off. The Little Piton is very flat, and is connected to the South point of the greater one by a continued ledge of rocks. The whole of the eastern side of the Great Piton is rocky and dangerous.

The following description is appended to an account of a visit made to them in 1813, by Rear-Admiral Hercules Robinson :—

"The Great Salvage Island appears to be frequented during certain periods of the year by the Spaniards and Portuguese for the purpose of collecting the barilla, with which the top is covered. It produces no other vegetable substances, being an entire mass of volcanic matter and rocks, with strata of loose clay. On the N.E. point of the island we found a small spring of fresh water, but not in sufficient quantity, I should apprehend, for the consumption of a ship; but water, I have been assured, may be obtained in any quantity by digging any part of the flat surface at top. We were unable, however, to establish the truth of this fact.

"The island is almost covered with a description of large sea-fowl (cormorants), which our men ate, and with a quantity of rabbits, both of which are so abundant, and the birds so easily caught by the hand, that any amount of this description of food may be depended on should circumstances induce the necessity of having recourse to it.

"The best, indeed the only, anchorage we could discover at the Great Salvage, was round the East point in a little bight (where there is good landing), half a mile off shore, in 12 fathoms, clear ground. East point, E. by N.; West point, N.W. by N.; a rock showing its surface, on which the sea breaks heavily, N.W. by W. Care must be taken not to anchor farther off those than half a mile, as without that distance the water deepens rapidly, with sharp coral rocks.

"All the dangers round the Great and Little Salvages show themselves by breakers from the heavy swell of the sea.

"The Little Salvages are apparently of the same description as the Great Salvage, but lower, and without any anchorage that we could discover or learn; the difficulty of landing is very great indeed (owing to the swell accumulating from reef to reef), except in summer, when, after a continuance of calm weather, the agitation of the water subsides."*

* Nautical Magazine, October, 1851, pp. 509—517. The occasion and result of the visit is there amusingly related. In substance it is, that, in 1804, the crew of a South American Spanish ship, bound to Cadiz with produce, and about two millions of dollars in chests, rose upon and murdered the captain, off some islands corresponding exactly in description and site with the Salvages. The treasure was carried on shore, and buried in the white sand above high-water mark in a snug little bay on the South side of the island, and over it was buried also the body of the murdered captain. This tale was told to an English sailor by one

Allegranza, *Clara*, and *Graciosa* are now only visited for the orchilla, or archil, which is found upon them, and which is valuable for its use in dyeing. Clara is noted for its beautiful Canary birds, and it yields pasture for goats.

LANZAROTE is very high, and its mountains may be discerned at a great distance. On approaching, it appears black, rocky, and barren, and it has many extinct volcanoes. From its northern extremity, in lat. 29° 15′, a barrier of precipitous cliffs rise to the height of 1,500 feet, extend in a S.W. direction 7 miles, and terminate in a sandy plain, where, in 1825, a volcanic eruption took place, and two considerable hills were thrown up, which were burning in 1835: a stream of lava, from 200 to 300 yards broad, found its way to the sea in the bay. The shore along all the N.W. side to the S.W. extremity of the island is high and precipitous, with the exception of a cove, called *Janubio*, once a harbour for small vessels, but converted into a salt-water lake by an eruption, in the year 1765.

On the eastern side of the island the shore is much lower than the western: near the middle of it is the Port of *Naos*, a small but secure harbour, formed by several rocky islets, and having two entrances, the northern with a depth of 12, and the southern of 17½, feet, at low water, with a tidal rise of 9 feet. During winter, nearly all the vessels of the island resort to this place. Two bomb-proof forts, the one mounting eleven, and the other twelve, heavy guns, defend the respective entrances. The town of *Arricife* is situate immediately to the southward of the port: many of its houses are large, and the streets are spacious; inhabitants about 2,500. The entire population of the island is estimated at 17,500.

The greater part of the inhabitants of Arricife are engaged in the fishery on the opposite coast of Africa, which gives employment to between 400 and 500 men from this island alone, about 250 from Fuertaventura, and proportionably from the other islands.

The highest land in Lanzarote is *Montana Blanca*, 2,000 feet in height above the sea, situate nearly in the centre of the island, and cultivated to the summit. The wine of this island is very superior to that of the other islands; the grapes are superior in flavour; the soil selected for their cultivation is decomposed scoriæ.* Camels are used in Lanzarote as beasts of burden, on account of the scarcity of water.

PUERTO DE NAOS, &c.—Any vessel, not drawing more than 18 feet, may enter this port at high water, spring tides, and lie secure from all winds and weather; although, in sailing along the coast, the shipping appears as if at anchor in an open road, the harbour being formed by a ridge of rocks, not perceivable at any distance, as most of them are under water: these break off the swell of the sea, so that the inside is as smooth as a mill-pond. As there is no other convenient place in the Canaries for cleaning or repairing large vessels, it is much frequented for that purpose by the shipping trading to the islands.

On the West side of Arricife lies another port, called PUERTO DE CAVALLOS. This is also an excellent harbour, formed, like Puerto de Naos, by a ridge of rocks; but its entrance is shallow, there being no more than 12 feet of water in it, with spring tides. A square castle, built of stone, stands upon a small island between the two harbours, and so defends them both: this island is joined to the land by a bridge, under which boats go from one port to the other, or from Puerto de Cavallos to Puerto de Naos.

At the North end of Lanzarote is a spacious channel, called EL RIO, which is the strait dividing this island from the uninhabited one, called *Graciosa*. A ship, of any burden, may pass through this strait; for, if she keeps in the midway, between the two islands, she will have 6 or 7 fathoms of water all along.

The RIO is, in general, rather more than a mile wide, and forms the only safe harbour in the Canaries for large ships; but the extreme difficulty of communication with Lanzarote presents an insuperable obstacle to its being resorted to as a harbour for trade. Here basaltic cliffs rise almost perpendicularly to the height of 1,500 feet, and can be climbed only by a narrow path which winds along the face of the precipice; halfway up the cliff is the only spring of fresh water in the island, but rendered useless from its

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of the two survivors, whose tale led to the unsuccessful search by the *Prometheus*. Still the tale appears credible.

* The preceding description of Lanzarote is chiefly that of Lieutenant Arlett, 1835.

situation, except to a few goatherds. From the bottom of the cliff to the shore of Lanzarote is about two musket-shots distance. The ground in the space is low; and here is a salina, or salt-work.

On the N.E. extremity of Lanzarote are two remarkable rocks, composed of black vitrified matter, but in shape resembling the "Needles," at the western extremity of the Isle of Wight.

If a smooth place to lie in, while the trade-wind blows, be required, a ship coming into this harbour from the eastward must run a good way in, and double a shallow point, which lies on the starboard hand, taking care to give it a good berth; and this is easily done by approaching no nearer than in 4 fathoms; when past it, edge toward Graciosa, and anchor in any convenient depth; for it shoalens gradually toward the shore, close to which there are 2 fathoms.

This is a commodious place, in the summer season, for careening large ships; for a man-of-war, of any nation that happens to be at war with Spain, may come here and unload all her stores, &c., on the Isle of Graciosa, and heel and scrub. Or, if two vessels chance to come in together, the one may heave down by the other; in doing which, they need not fear any opposition from the inhabitants, for there is neither castle nor habitation near this spot.

The water, however, is not so smooth here as at Puerto de Naos, especially if the trade-wind happens to blow hard from the East, which sends in a swell that makes it troublesome, if not impossible, to careen a ship properly. But the wind here does not often blow from that quarter, those winds which mostly prevail being from North and N.N.E. In mooring here, great care must be taken to have a good anchor, with a large scope of cable toward Lanzarote; for in East and S.E. winds heavy gusts or squalls come from the high land of that isle. In the winter the wind sometimes shifts to the S.W.; then it is necessary to weigh, and run back to the eastward, round the shallow point before mentioned, until the ship be sheltered from that wind, and there anchor.*

THE LITTLE CANARIES.—The ISLE ALLEGRANZA, the northernmost of the Canary Islands, is composed of lava and cinders, the remains of an extinct volcano. It rises to the height of 939 feet above the sea. The edge of the crater is well defined, and two-thirds of a mile across; its bottom is cultivated for barilla. The western cliffs are precipitous, and 700 feet in height. About 40 persons were resident on the island in 1835, principally employed in collecting orchilla.

The only landing-place is on the South side, where a cavern extends about 500 paces, slanting from the sea, and terminates in a little sandy bay, open above. At the entrance, the rocks form a natural jetty. The village is situate immediately above, and abreast is the only anchorage, half a mile from shore.

GRACIOSA, forming the North side of the Rio of Lanzarote, is about 5 miles in length and 2 in breadth; and, as may be inferred from its appearance, it is destitute of water. Allegranza is 7 miles to the northward of it.

Near Clara is a dangerous rock, 3 or 4 fathoms high, and covered with scoriæ, resembling coke. In the old charts it is called the *Infierro* or Hell Rock, and may have been higher. It is now called the *West Rock*, or *Roca de Ouest*.

Eight miles to the eastward of Graciosa stands the *Roca del Este*, or the East Rock, the craggy summit of an extinct volcano. Many ships have been wrecked upon these islets in the night, being misled by errors in their reckoning and by the currents.

FUERTAVENTURA, or FORTAVENTURA.—This island is divided from Lanzarote by the channel named *Canal de Bocayna*, which is 6 miles in breadth: the island, as shown by chart, is singularly formed and variegated; it is less mountainous than the other islands, yet both the northern and southern extremities rise to 2,500 feet above the sea.

It has two ports of trade; *Cabras* on the East, and *Tarajalejo* on the S.E.; but Cabras contains little more than 1,000 inhabitants. The anchorage at the latter is indifferent, and at the landing-place, a beach of shingles, still worse. The exports shipped hence consist of barilla, orchilla, corn, camels, honey, and goat-skins.

Lieutenant Arlett says that, although the general feature of Fuertaventura is extreme

* Particular plans of this strait, and of the Harbours of Naos and Cavallos, are given in our Chart of the Azores, &c.

barrenness, still there are many spots of great fertility; the most conspicuous of these is the valley of *Oliva*, toward the North end, where there is a village of the same name, the residence of the lieutenant-governor, a descendant of the Baron Béthencourt, who possesses a very considerable portion of the island. The valley of Oliva is about 15 miles long, and generally from 2 to 3 wide. The only two streams of pure water in the island have their rise in the mountain of the Atalaya, or watch-tower; they are husbanded with great care, and irrigate the whole of the valley.

A paved road across the island, from Cabras to Betancuria, is the only one existing; the other ways being mere tracks following the direction of the valley, where the ground is less encumbered with stones, and softer to the camel's feet. The population is from 17,000 to 18,000, scattered in small villages over every part of the island.

The interior formation of Fuertaventura is as follows: to the North is a group of extinct volcanoes; some of them, as *Monte Mudo*, on the N.E., rise to the height of 2,160 feet; and they branch to the southward of Port Cabras, East and West to the sea, thence following the direction of the coast on each side for about 30 miles; again uniting, they encircle an extensive and arid plain and several detached villages. From the summit of the hills, the course of some brackish streams may be traced by the verdure they impart. There are also date palms, the only trees, excepting the fig, on the island.

From the southern point of junction of the mountains, one of which, *Chilegua*, on the western coast, reaches the height of 2,160 feet, a narrow sandy isthmus, about 5 miles long and 2¼ broad, projects, connecting it with the southern extremity of the island, a peninsula, occupied by the *Monte Jandia*, a mountain which presents the most remarkable features; from the N.W., its precipitous face is seen to rise to the height of 2,820 feet; and spurs, or buttresses, diverge from its centre to the N.E., East, and S.E., by any of which it may be ascended to a frightful ridge on the summit.

On the South side of the eastern entrance of the Bocayna, very near the N.E. shore of Fuertaventura, lies the little Island of *Lobos*, or Seal's Isle, which is about 1½ leagues in circumference, uninhabited, and destitute of water. Near this isle is a good road for shipping; the mark for which is, to bring the East point of Lobos to bear nearly N.E. by N., and anchor halfway between it and Fuertaventura, or rather nearest to the latter. Although this road seems to be open and exposed, yet it is very safe with the trade-wind, for the water is smooth, and the ground everywhere clean, being a fine sandy bottom. Directly ashore from the road, on Fuertaventura, is a well of good water, of easy access.

Through the broad channel, *La Bocayna*, ships sail very safely, as it is deep in the middle, and shoalens gradually toward Lanzarote, near to which are 5 fathoms of water; but very near or close to Lobos, the ground is foul and rocky. In this passage vessels of any burden may find room enough to ply to windward, and there is no necessity of approaching too near to Lobos.

When a vessel comes from the eastward, with the trade-wind, and is passing through the Bocayna, to the westward, so soon as she brings a high hill on Lanzarote directly to windward of her, she will be becalmed, and soon have the wind at S.W. Should this happen, make short tacks until you obtain the trade again, or a constant northerly wind, the first puff of which will come from West or W.N.W. So soon as this is perceived, you must not stand to the northward, otherwise you will immediately lose it again, but must steer toward Lobos; for the nearer you approach this isle, the more will you have the wind; so that, before you are two-thirds over, you will meet with a steady wind at North, or N.N.E.

When there is a great westerly swell hereabout, the sea breaks horribly on the rocks at the N.W. end of Lobos. Captain Glas affirms, that he has seen breakers there nearly 60 feet high; of which, were one to strike the strongest ship, she would be staved to pieces in a moment. "When I first saw," says Captain Glas, "those mighty breakers, our ship had just passed through the channel, between Fuertaventura and Lobos; we had a fine brisk trade-wind at N.N.E.; and although there were no less than 10 fathoms of water, when we came into the westerly swell, yet we trembled lest the waves should have broken, and thought ourselves happy when we got out of soundings. We heard the noise of these breakers, like distant thunder, after we were past them 6 or 7 leagues."

Point Jandia, or *Handia*, the south-western extremity of Fuertaventura, is a low rocky point, placed by the Chevalier de Borda in lat. 28° 4′, lon. 14° 31′, and by Lieutenant Arlett in 28° 3′, and 14° 32′. A rock lies at half a mile from it to the S.W.

CANARIA, or GRAND CANARY.—The Isleta, or N.E. point of this island, lies 16 leagues N.W. by W. ¼ W. [*W. by N.*] from Point Handia, the S.W. end of Fuertaventura; and, in clear weather, either of these islands may be seen from the other. The centre of Canaria is exceedingly high, and full of lofty mountains, which tower so far above the clouds as to stop the current of the N.E. wind that generally prevails here; so that when this wind blows hard on the North side of the mountains, it is either quite calm on the other side, or a gentle breeze blows upon it from the S.W.* This island is the granary of the Canarian Archipelago, and has, in some districts, two wheat harvests in the year—one in February, the other in June.

On the N.E. end of Canaria is the peninsula called the Isleta, 2 or 3 leagues in circumference; the isthmus, by which it is connected with the main island, is low and sandy, about 2 miles long, and a quarter of a mile broad at the narrowest part. On each side of this isthmus is a bay, which, being exposed on the N.W. side to the swell of the sea, is, therefore, an unfit road for shipping; but small barks get in between a ledge of rocks and the shore, and lie there smooth and secure from all winds and weather. Here the natives repair their small vessels.

On the other side of the isthmus is a spacious sandy bay, called, by some, *Puerto de Luz*, and by others, *Puerta de las Isletas*, from some steep rocks, or islets, at the entrance of the bay, toward the N.E. This is a good road for shipping of any burden, with all winds, except from S.E., to which it is exposed; but that wind, which is not common here, seldom blows so hard as to endanger a ship.

The landing-place is in the very bight, or bottom, of the bay, where the water is generally so smooth, that a boat may lie broadside to the shore, without danger. Thence, along shore, about a league to the southward, is the city of Palmas, the capital of the island. Shipping, that discharge their cargoes at Palmas, generally anchor, in good weather, within half a mile of the town, for the quicker dispatch; but that place is not a good road.

The next port of any consequence in Canaira is *Gando*, situated in the middle of the East side of the island. It is a good place for shipping with all winds, except from the southward; and there good water, with other refreshments, may be had.†

Las Palmas is a large handsome town, containing 18,000 inhabitants: it has a cathedral, hospital, and college, with convents of different orders. It is well supplied with water, having fountains in all the principal streets; and its market, likewise, is well supplied. The city appears to great advantage from the sea, the streets rising regularly above each other, which gives it a very commanding aspect. It extends at least a mile in length. There is another large town, with a lofty church, about 4 or 5 miles to the southward, which stands considerably higher and more inland than Palmas. From the number of houses seen, while sailing along the island, it has the appearance of a considerable population, and of being well cultivated.

Canary affords more anchorages than any of the other islands: the bank almost everywhere extending farther. During summer there is here a constant N.E. wind; the land, obstructing its course, causes the calms which prevail off the S.W. shore to the distance of 8 or 9 miles, when the aerial currents again unite. Within this space a westerly current runs close in-shore, which is advantageous to the coasters.

El Cumbre, or the summit of the highest peak of Canary, has been stated by Lieutenant Arlett to be 6,648 feet above the level of thesea: the mountain *Sancillo*, near the centre of the island, which has a large wooden cross on its summit, 6,070 feet.

TENERIFE, or TENERIFFE.—Point Naga, the N.E. end of Tenerife, bears N.W. ¾ N. [*N.W. by W.*] 15½ leagues from the N.E. point of Canaria; but, from the western part of Canaria to the nearest part of Tenerife, the distance is 10 leagues. In the centre of the island is the famous peak, called, by the ancient and present inhabitants, the *Peak of Teyde*.

The Bay, or Roadstead, of Santa Cruz, on the N.E. coast, is the most frequented of any in the Canaries.

* A description of these calms is subjoined to the present section.

† The pilots of Tenerife assert that a rock, with only 12 feet of water over it, lies W.N.W. 2¼ leagues from Point Aldea, the western point of the Grand Canary, and that the sea breaks on it in rough weather. Its precise situation appears to be unknown.

On coming toward the island, in clear weather, the peak may be clearly discerned at a great distance;* it first appears like a thin blue vapour or smoke, very little darker than the sky; at a farther distance the shade disappears, and is not distinguishable from the azure of the firmament. Before you lose sight of this towering mountain, it seems at a considerable height above the horizon, although, by its distance, and the spherical figure of the earth, all the rest of the island, the upper part of which is exceedingly high, is sunk beneath the horizon. But, in general, in sailing toward Tenerife, when the trade-wind blows, the island appears as a haziness of the sky, or as a cloud, till within the distance of 5 or 6 leagues, and then the headlands show like land, and are first conspicuous.

TENERIFE presents to the curious eye the most singular object, perhaps, in the northern hemisphere. The island appears, on sailing along the coast, from North to South, to have once been a complete cinder; and presents to view a great deal of the brokenness and irregularity of half-consumed coke. This resemblance, however, contrary to expectation, becomes less perfect as we approach the peak, the great chimney of the fiery caldrons boiling beneath.

The Baron Humboldt's ascent of the peak is given in the *Nautical Magazine*, No. 47, January, 1836; and it is there stated, that the volcano has not been active at the summit for thousands of years, its eruptions having been from the sides; the depth of the crater being only about 120 feet. The peak forms a pyramidal mass, having a circumference at the base of more than 57,105 fathoms, and a height of 12,176 feet, or rather more than 2 geographic miles. Two-thirds of the mass are covered with vegetation, the remaining part being sterile, and occupying about 10 square leagues of surface. The cone is very small in proportion to the size of the mountain, it having a height of only 537 feet. The lower part of the island is composed of basalt and other igneous rocks of ancient formation, and is separated from the more recent lavas and the products of the present volcano by strata of tufa, puzzolana, and clay.

Captain Beechey, in his narrative of the voyage of the *Blossom*, observes—"As I purposed touching at Santa Cruz, we immediately hauled up for the land, and it was a fortunate circumstance that we did so; for so strong a current set to the southward during the night, that, had we trusted to our reckoning, the port would have been passed, and there would have been much difficulty in regaining it. I mention the circumstance, with a view of bringing into notice the great southerly set that usually attends the passage of ships from Cape Finisterre southward. From this cape to Point Naga, our error in that direction, or more correctly *S.* 33° *W.* (*true*), was not less than 90 miles."

At a short distance from Point Naga, the N.E. point of Tenerife, are some high perpendicular rocks; and 4 or 5 leagues thence, on the East side of the island, is the bay or roadstead of SANTA CRUZ.† The best road for shipping here is between the middle of

* They say, in the Canaries, that the peak, in very clear weather, is seen from La Bocayna, or the channel between the Isles of Lanzarote and Fuertaventura, at the distance of about 50 leagues.

"The Peak of Tenerife is probably the most striking monument of nature in the world; for, though the Chimborazo (in South America) soars to the height of 22,000, and the Himalayan Dewalgiri (in Asia) to the astonishing height of 27,000, while Tenerife is but 12,176, yet the latter, by its arising directly from the level of the sea, is seen more conspicuously, and stands at a more magnificent elevation. The view from the summit, which it requires a whole day to ascend, is unspeakably grand. On the top of this vast pyramid of basalt is a crater, 40 yards deep, from which vapour continually ascends, and specimens of finely crystallized sulphur are gathered round its lips. From this summit, when the sky is unobscured, the whole island is seen like a model. Rising around it, at a distance, are seen the Canaries, glittering on the horizon, their peaks and pinnacles coloured by every change of day. At favourable times, Madeira and the African coast are visible."—*Captain Alexander*, 1837.

Baron Humboldt says—"It may be admitted in general that the Peak of Tenerife is seldom seen at a great distance in the warm and dry months of July and August; and that, on the contrary, it is seen at very extraordinary distances in the months of January and February, when the sky is slightly covered, and immediately after a heavy rain, or a few hours before it falls."

† QUARANTINE REGULATIONS, 20th November, 1832.—On the appearance of a British ship, a boat with a pilot, and carrying the Royal Spanish flag, will leave the mole, and point out the quarantine anchorage. If from circumstances it should be necessary to anchor before communication can be had with the boat, the line of quarantine anchorage is S.E. and N.W.

the town and a fort, or castle, about a mile to the northward of it. In all that space ships anchor, from a cable's length distance from the shore, in 6, 7, and 8 fathoms of water, to half a mile, in 25 or 30 fathoms. Particular care must be taken, in going in, not to bring any part of the town to the northward of West, lest calms should be occasioned by the high land under the peak; otherwise you will be in danger of driving upon the shore; and, when ashore, will have no ground on the opposite side of the ship, with 200 fathoms of line, so that anchors and cables are of no use.

When a ship lies any time in the road, it is necessary to buoy her cables, otherwise the ground, being in some places foul, may chafe and spoil them. Here vessels, if moored with good cables and anchors, may lie securely in all winds, although the bay is exposed and open to those which blow from the N.E., East, and S.E.; however, it is not above once in the space of four or five years that they blow so hard as to cause any considerable damage. The surf frequently beats on shore, with great violence, for several days together; and the pier is ill-contrived for shelter.*

The following directions for the anchorage at Santa Cruz have been issued by *Mr. Richard Bartlett*, the British consul at that place:—†

"While running for the anchorage keep both leads going, and bring up to the northward of the Mole Head; or, bring the clock front of the square church with a cupola to bear W.N.W., and anchor with this mark on, or to the northward of it.

"Ships may anchor when in less than 30 fathoms. Give a large scope of chain cable. When the northernmost fort (Fort Paso Alto) bears N.N.E., the depth of water will be about 25 fathoms on the lines pointed out. The shore may be neared without risk, the water being deep, and no dangers that are not apparent. The anchorage to the South of the lines indicated is reserved for vessels in quarantine." The foregoing will be sufficient; but another good anchoring mark is, *not to bring the Mole Head anything North of W.N.W.* Variation, 22° 41′ West.

Lieutenant Church, of H.M.S. *Ætna*, makes the following observations on the anchorage of Santa Cruz:—"Whilst surveying the Canary Islands in the *Ætna*, we had, of course, considerable experience of Santa Cruz, and had no reason to consider it an unsafe anchorage. During the very many times that the *Ætna* was there, in only one instance did we experience a gale from the south-eastward. Most of the shipping slipped at the commencement, and got into the offing; but we remained at our anchors, and rode it out well. Although a heavy sea tumbled in, there was much less strain on the cables than might have been expected, arising, as it appeared to us, from an offset, which, together with there being a great uphill drag for the anchor, diminishes the chance of driving.

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by compass, with the mole-head (nothing to the North of it); distance from 2 to 6 cables' length from the land; the depth of water, 10 to 20 fathoms, rocky. Anchorage to the North of the line stated is for vessels admitted to free pratique. No ship is to lower boats, or communicate in any manner whatever, until visited by the health-boat, and permission obtained. Ships bound to any port in any of the Canary Islands, from infected countries, must come to this bay, which is exclusively appointed for the observance of quarantine.—*Santa Cruz, Tenerife*, 20th November, 1832.

* "The BAY of SANTA CRUZ is much exposed to all winds between E.N.E. and S.W. by W.; and, as the easterly winds are very prevalent, there is generally a great swell setting in, although it seldom blows hard from that quarter of the compass.

"In 17½ fathoms, fine sand and blue clay, directly off the jetty, with the end thereof on with the gateway leading into the town, bearing about N.W., is a convenient berth for watering, and good ground.

"The jetty is built on a curve, to break off the swell, for the convenience of boats, being the only landing-place, where all goods are landed and shipped. Ships generally lie off the jetty, in from 17 to 35 fathoms, good holding-ground. The best mark is the high square building, like a lighthouse, just over, and in one with, the mole or jetty head.

"Tide rises about 4 feet; sets round the bay. H. W. $4^h\ 30'$ (?)"—*Mr. William Wood, H.M.S. Tartar*, 1823.

The Chamber of Commerce at Santa Cruz notified July 12th, 1850, that the works of the mole had sufficiently advanced to permit the embarkation of coals at all hours, independent of tide, and that coals were abundantly provided.

† Dated, Santa Cruz, August 12th, 1842. See *Nautical Magazine*, April, 1843, p. 217; and also August, 1843, p. 551.

"The church tower with the cupola (San Francisco) open a little to the right of the Mole Head, is considered the usual anchorage, and vessels congregate here to be near the landing-place. But, in a man-of-war, I would (especially if there are many vessels here) anchor considerably to the north-eastward or windward of this resort, the bank of soundings being wider, and to avoid having merchant ships in the hawser; indeed, I see no reason why ships should not anchor nearly as far North as the Paso Alto Battery, the most northern battery, in case the roads are crowded with shipping.

"I have noticed that ships, coming from the north-eastward to Santa Cruz, run down at too great a distance from the land, and do not haul in till they get nearly abreast of the town. They get a cast or two of the lead with no bottom, and immediately they get into soundings, the anchor is let go in a hurry, the bank being narrow, and the ship's head in-shore, there being little time for consideration.

"Instead of this method of proceeding, I think it would be advisable, on making the N.E. end of Tenerife, Punta de Anaga, to haul in upon the bank of soundings immediately on passing Punta de Antiquerra, as from this point to Santa Cruz the bank extends as far out from the land as at the town, and the anchorage is just as good and as safe anywhere when abreast of the Barrancos. I would get into the depth nearly that I wished to anchor in, and then run down with the light wind parallel to the shore. Besides having time to anchor leisurely, there is the advantage of being enabled to let go the anchor under foot, wherever you may be.

"Should it fall calm while the ship is outside soundings, she may be taken away to leeward by the southerly set, which once caused us twenty-four hours' trouble to get back again. From experience, we latterly adopted the system I have mentioned." *

Captain Vancouver anchored here, in 1791, and, in relation of his voyage, has stated—"We had the mortification, this morning (May 1st), of finding the small bower cable cut through nearly in the middle, which seemed to have been occasioned by an anchor lying at the bottom. The loss of an anchor, where no other could be procured, was a matter of serious concern; no pains were spared to regain it until the afternoon of the 5th, when all our exertions proved ineffectual; and, being apprehensive that other lost anchors might be in the vicinity, we weighed, went further out, and again anchored, in 30 fathoms, on a soft, dark, oozy bottom, intermixed with small white shells, having the northernmost church steeple in a line with the centre of the jetty, bearing (by compass) N. 48° W., and the southernmost fort S. 71° W., about three-quarters of a mile from the town. This anchorage appeared to be so far preferable to our former situation, being nearly as convenient to the landing-place, without the hazard of damaging the cables by anchors which small vessels might have lost nearer in-shore; and which is the only danger to be apprehended here, as the bottom is good holding ground, and, to all appearance, perfectly free from rocks."

Captain Vancouver has observed that, when he was here, he found the wine, water, and beef, exceedingly good, and was therefore induced to take some days' supply of the latter to sea; but fruit, vegetables, poultry, and all kinds of live stock, were very indifferent, and most extravagantly expensive.

The water is easily procured when the surf is not great on the beach. A good supply of wine may also be readily had.

The aspect of Santa Cruz is gloomy, and the heat is commonly excessive. On a narrow and sandy beach, houses of dazzling whiteness, with flat roofs, and windows without glass, are stuck against a wall of black perpendicular rocks, stripped of vegetation. A fine mole, built of freestone, and the public walk, planted with poplars, are the only objects which break the sameness of the landscape.

Captain FitzRoy says:—"About noon [Jan. 6, 1832] we approached the sun-burned, uninviting town of Santa Cruz; lying upon a level, arid space, at the foot of hills that rise slowly to a considerable height, so as to shut out the more elevated part of the island; hardly a tree to be seen, and no appearance of cultivation; guarded by a rocky shore, on which there is always a disagreeable, often a dangerous, surf; it offers, indeed, little to tempt delay: but, notwithstanding this unpromising exterior, and a port so exposed that Spanish ships of war were ordered by their government to moor there with four anchors; there is much to be found in the higher and interior parts of Tenerife which amply repays the labour of ascending to and exploring those regions."—Vol. ii. p. 48.

* *Nautical Magazine*, Feb., 1844, p. 86.

Captain Owen has said—"Our approach by night [toward Santa Cruz] was past a line of fishing-boats, each of which had a fire of canary pine at the bow and stern, which produced a beautiful effect; and, as they anchor to fish on the outer verge of the bank, they are good marks for vessels, being sure of soundings when in the same line with the fishermen's lights. Immediately on anchoring, they brought their fish alongside for a market. It consisted principally of a species of horse-mackerel, caught with rod and line."

* The situation of Santa Cruz appears badly chosen, as regards anchorage for ships, the communication with the shore, and obtaining water; in all which particulars the next bay, about a mile to the eastward, has great superiority. The town is small, and at a distance presents a rugged and barren appearance.

Santa Cruz is frequented by outward-bound ships for the purpose of obtaining a stock of wine, which can be procured at a cheaper rate, and frequently of as good a quality, as that of Madeira. At the time of the *Chanticleer's* visit, in 1828, the price of very good wine was £20 the pipe of 100 imperial gallons; this was called the "London Particular;" but the best old wine was only £12 the pipe, and it, in general, cannot be distinguished from the ordinary wines of Madeira.

Admiral Krusenstern says that, "of Santa Cruz the characteristics are, the general misery and profligacy of the people, the gross depravity of the female sex, and the swarms of fat monks, who stroll about the streets as soon as it is dark. These objects excite, in the mind of a stranger, the sensations of pity and disgust.

"Upon the arrival of the Russian frigates toward the road, in 1803, Don Carlos Adam, lieutenant of the Spanish navy and captain of the port, came immediately on board, and recommended us to keep to the eastward of the road, as the best place of anchorage, where we brought-to in 36 fathoms. The ground is not so rocky here as it is in other parts of the road, nor are there so many lost anchors in the ground, which is frequently the occasion of the loss of others."

From this cause the *Neva*, which lay more to the S.W., lost a sheet-anchor and two cables, while the *Nadeshda's* cables did not suffer in the least. It is, however, necessary to take the precaution of buoying them up with casks to keep them floating; I would recommend this situation in preference, notwithstanding the great depth of water, and will therefore give the exact situation of the ship after we had let go our other anchor to the N.E. in 24 fathoms of water. The N.E. point of the road bore N. 69° E.; the S.W. point, S. 36° W.; and the church of St. Francis, which is distinguished by a very high tower, S. 51¼° W. There is, indeed, this disadvantage attending the situation, that, should a storm spring up at S.W., and the ship not likely to ride it out in the road, it would be very difficult for her to beat out. Violent storms, however, are not common, even in winter; and, if the anchor and cable can be depended upon, it is better to remain in the road. The Spaniards, and they alone, moor with four anchors; two to the N.E. and two to the S.W., in compliance with an ancient law.

The mean of the several observations, which were taken in the road, made the latitude of our anchorage to be 28° 27′ 33″; and the longitude, by Arnold's large watch, No. 128, 16° 12′ 45″. The longitude, as settled by the Chevalier de Borda and M. Varela, is 16° 15′ 50″.*

* Remarks of Captain Lisiansky, of the *Neva*.—"The Bay of Santa Cruz is not a safe anchoring-place, especially in winter, from its being open to the S.E., a quarter from which the wind sometimes blows with great violence. To this may be added, that it has, in many places, a rocky bottom, and abounds so much with lost anchors and warps, that it is necessary to buoy up the cables to prevent their chafing: we found three small casks to each of our cables to be sufficient for the purpose. We were moored S.S.E. and N.N.W., having Fort Christoval N. 81½° W., South Fort S. 55¼° W., and St. Raphael N. 5° E.; and the only damage we sustained was the loss of a warp, which we could not heave up when we unmoored.

"To come into the bay, you must sail close in-shore, after passing around the N.E. part of the island; and you should endeavour to get bottom as soon as possible; for which purpose a heavy lead with 50 fathoms of line should be in readiness. The shore here is very high, and so deceiving, that, when I thought myself 4 leagues from it, I afterwards found, by my run, that I had been mistaken by nearly half that distance.

"During our stay here the peak was so constantly overclouded, that we could see it distinctly only twice. The summit was then (in October) covered with snow; but this is not the case, we were informed, in the months of June and July. The latitude of our anchoring-place, according to the different meridian altitudes, appeared to be 28° 26′ 36″ N."

In 1820, or 1821, H.M.S. *Tartar* anchored in the road of Santa Cruz, in 26 fathoms, dark

OROTAVA, &c.—The next best port to that of Santa Cruz is the port of *Orotava*, on the western side of the island, and which lies about 8½ leagues to the south-westward of Point Naga. Here the riches and fertility of the island are chiefly to be found, for here the wine is mostly made, and shipped when the weather allows. It is a good harbour in the summer season, or from the beginning of May to the end of October; but in winter, ships are often obliged to slip their cables, and put to sea, lest they should be surprised by a N.W. wind, which throws in a heavy sea: luckily, these winds rarely happen; and, in general, give warning, so that a vessel has time to get away. Straggling rocks project about 2 ships' length from shore, on which the sea breaks furiously. It is commonly calm in the road, but there is almost always a long northerly swell, that causes ships to roll very much.

The anchorage is in 50 fathoms, about 1½ miles from shore, with the peak bearing S.W.; and it is proper to continue a pilot on board whilst lying here.

Orotava stands upon a gentle slope at the foot of the mountain, and is surrounded by fields of corn, gardens, and vineyards. The culture of the soil is here promoted to a very extraordinary degree, particularly in some patches so elevated and so secluded as to appear inaccessible to the husbandman. But the plain is very forbidding; and the beach is composed of naked, pointed, and cinereous, or scorched rocks.

Such, formerly, was Orotava; but the memorable hurricane of the 7th and 8th of November, 1826, destroyed, in one night, at least one-third of the whole surface of the valley, and converted a beautiful and highly-cultivated landscape into a dreary, rocky, unproductive wilderness. The hurricane affected, in particular, all the northern side of the island, where buildings, vineyards, orchards, and other valuable property, to a great amount, were utterly destroyed. Whole villages were swept into the sea by the irresistible violence of the flood gushing down the mountains; many lives were lost, and thousands reduced to distress. At Orotava, *La Jeune Gabrielle*, a French vessel of 300 tons, was wrecked, and only four persons saved. At Santa Cruz, part of the castle of S. Miguel was washed away, and three brigs were wrecked.

ADVICES from TENERIFE, dated the 11th of November, 1816, stated the great embarrassments foreign ships have to encounter on their arrival at that island, from want of a knowledge of the regulations to be observed. Almost all the British vessels, and particularly the East India ships, which have had occasion to touch at the island for refreshments, have been subject to a heavy expense, and much vexatious delay, by the want of bills of health, and by other omissions. To prevent inconvenience, it is necessary to observe the directions for British vessels frequenting the Island of Tenerife. The directions are as follow:—

"A bill of health is an indispensable document for a vessel's admission here, from whatever port she may arrive. The quarantine laws are very rigorously enforced, and the want of a bill of health subjects vessels, even from England direct, to a quarantine, that is never removed without the ceremony of repeated health-visits, and payment of heavy fees. Great care must be taken not to get to leeward of the island, as it is a tedious and difficult matter to get up again, the usual and prevalent winds being between N.N.E. and E.N.E. Point Naga should be made, which is the N.E. point of the island; it is very high, and is easily to be known by two large high rocks lying close to it, which appear like ships, and may be seen 7 or 8 leagues off. You must then run down till you come within 2 or 3 leagues; and if bound to Port Orotava, you must steer down along the North shore (which is very bold, and quite free from danger), keeping 2 or 3 leagues' distance; and, after running down 8 or 9 leagues, if you should not see the Peak, which is often clouded, you will see a large white town (Orotava) on the side of the high land, about a league inland, with two small regular shaped green hills under it, between which you must steer directly in, and, by doing so, will raise, as it were, another town out of the sea. This is Port Orotava, for which you must steer directly in, until you meet the pratique-boat, which will be about 2 or 3 miles off; it is a low boat, and comes with the Spanish colours set upon a staff: at any rate, you must not be afraid of

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sand and mud, with the S.W. point of Santa Cruz S.W. ½ W., the church in the middle of the town W. by N. ½ N., and the easternmost battery N. by E. ½ E. At 1½ miles without the ship, no bottom at 150 fathoms. Stock of all kinds was then plentiful; the bullocks large, weighing from four to seven hundred-weight. Ships in want of water can always be supplied, on moderate terms, by the boats belonging to the place.

running in for the land, as it is very deceiving, and you will be 4 or 5 leagues off when you do not think yourself so many miles; and in that case you will not soon get a boat, for they do not come off until you approach very near. The boat, when she comes, brings a pilot, and leaves him on board: you must also bring with you your register, pass, clearances, &c.; and you must take care not to deliver either letters or other papers (except your bill of health), to any person who may ask for them, without some document, either from your consignee or the consul.

"In running down, you must prepare your anchors and cables, and it is customary to bend your small bower cable, with which you will bring up, with only one turn round the windlass, in order that it may run out quick, as the spot where you ride (about half a league off, and to the westward of the town) is very small; and if there be many vessels there, it is necessary that your anchor go very quick, as you bring up in from 30 to 40 fathoms of water; but there is little or no tide, and she will bring up easily. You must give her the whole cable round the windlass; your buoy-ropes should, therefore, be 45 fathoms long. During the summer months, from April to October, all vessels are moored in an inner harbour, or creek, with iron chains, kept by the merchants for that purpose. Vessels that fall to the leeward very often lose much time by mistaking Garachico for Port Orotava, from whence it is distant 4½ leagues West. There is some similarity in the appearance of these places, Garachico having also above it a white town, inland, called Icod; but besides, by their situation, Garachico being much nearer Point Teno, the West point of the island, these places are very easily distinguished by the above-mentioned two equally-formed round green hills. Point Naga lies in 28° 36′, and the Salvages lie *true* North from the point, distant about 28 leagues.

"The Grand Salvage is very high, and may be seen at 10 or 12 leagues off. Your direct course from the Grand Salvage to Port Orotava is S.W. (by compass), and distance 38 leagues; but particular care must be taken not to fall to leeward. The Peak of Teneriffe may sometimes be seen 40 leagues off, but it is very often hidden by clouds. Should it happen in the winter that you arrive off Port Orotava, during a N.W. or N.N.W. gale, which rarely occurs, but throws in a very heavy sea upon the coast, and would prevent a boat going off to you, it is best to bear away for Santa Cruz, on the S.E. side of the inland, after doubling Point Naga.

"Santa Cruz is the preferable place to touch at, for vessels in want of water and refreshments. All vessels on approaching these ports, ought to hoist their colours, and show their consignee's signal; or, when unconsigned, and only visiting the island, a Union Jack at the fore, and a white flag, with a pendant over it at the main, in order that boats may be early sent off to them by their consignees, or by the consul."

PALMA.—From the western end of Teneriffe to the nearest part of the Island of Palma the distance is about 15 leagues. The summit of this island is higher than the general level of Teneriffe, its peak excepted; hence some navigators run toward it with great confidence in the night.

The chief port is that of Santa Cruz, on the East side of the island. The mark by which a stranger may find it is the following:—When he approaches the East side of the island, Palma will appear shaped exactly like a saddle. Let him steer so as to fall in a little to windward of the lowest place, or middle of the saddle, till he comes within a mile of the land; then, running along shore to the southward, he will perceive the town close by the sea shore, and the shipping lying in the road; but, as the land behind the town is high and steep, one cannot discern the shipping till within a mile of them. The road is within a musket-shot of the shore, where vessels commonly ride in 15 or 20 fathoms of water, and are exposed to easterly winds; yet, with good anchors and cables, they may remain with great safety in all winds; for the ground is clean and good, and the great elevation of the island, with the perpendicular height of the land facing the road, repels the wind that blows upon it, though ever so strong.

When there is a great N.E. wind at sea, it comes rolling into the bay, but the want of wind and the deepness of the water deprive it of strength and power; so that ships, in such a case, ride here with a slack cable. These circumstances render the road of Santa Cruz, in Palma, more secure than any of those of Canaria or Teneriffe; but, in the winter, the rolling swell, which comes into the bay, breaks high upon the beach, and prevents boats from going off, or landing, for the space of three or four days together.

Santa Cruz de la Palma is a large town, but not so good and large as that of Palmas, in Canary, or the towns of Teneriffe. Near the mole is a castle, or battery, mounted

with a few cannon, for the defence of the shipping, &c. In the middle of the town, near the great church, is a fountain, filled by a rivulet, which plentifully supplies the inhabitants with good water.*

Tassacorta, the port next in consideration to that of Santa Cruz, is on the S.W. part of the island; it is exposed to westerly winds, and little frequented by any vessels, excepting boats.

In all the island there is no town of any note, excepting Santa Cruz; but many villages, the chief of which are St. Andrea and Tassacorta. In the north-eastern part, inland, is a remarkable high mountain, called La Caldera, or the Caldron, being hollow, like the Peak of Tenerife.

GOMERA.—The middle of Gomera lies W.S.W. about 5 leagues from Point Teno, of Tenerife. ST. SEBASTIAN, the principal town, is situated close by the sea shore, in the bottom of a bay, on the eastern side, where shipping lie land-locked from all winds, except the S.E. Here you may anchor at a convenient distance from the shore, in from 15 to 7 fathoms; but as the land-wind frequently blows hard, it is necessary for a ship to moor with a large scope of cable, otherwise she will be in danger of being blown out of the bay. The sea here is generally so smooth, that boats may land on the beach without danger. On the North side of the bay is a cove, where ships of any burden may haul close to the shore, which is a high perpendicular cliff, and there heave down, clean, or repair. When boats cannot land on the beach, on account of the surf, they put ashore on this cove, from whence there is a pathway along the cliff to the town.

The town has plenty of good water, which is drawn from wells in every part of it; and in the winter, a large rivulet from the mountains empties itself into the port. On the South side of the mouth of this rivulet stands an old round tower; and on the top of its perpendicular cliff, on the North side of the cove, is a chapel and a battery, with a few pieces of cannon, for the defence of the port.

To the best of my remembrance, says Captain Glas, the land that forms the North point of the bay is the most southerly point of land, on the East side of Gomera, that can be seen from Point Teno, on Tenerife. That land, when one is to the northward of it, at about a league distant, bears a great resemblance to Rame Head, near Plymouth Sound. In going into the bay, it is necessary to stand close in with this point, for the land-wind is commonly too scanty for a ship to fetch the proper anchoring-place; from that reason, it is better to come in with the sea-breeze, which generally begins to blow here about noon.

The best place for a ship to lie in here is, where a full view may be had along through the main street of the town, and at about the distance of a cable's length from the beach: it is necessary to moor as soon as possible, because of eddy winds that sometimes blow in the bay.

FERRO.—This island, the westernmost of the Canaries, has neither road nor harbour worthy of particular description. It has one church, but the town is inconsiderable. The land rises steeply from the sea, and is craggy on all sides for about a league, so as to render the ascent very difficult. It produces, however, many trees and shrubs, with better grass, herbage, and flowers, than any of the other islands, so that bees and honey abound. The wine is poor, and there are only three fountains or springs of water on the island.

DIRECTIONS FOR SAILING AMONG THE CANARY ISLANDS, BY CAPTAIN GLAS.

If a ship, lying at Palma, wants to go to Lanzarote, and will not wait for a fair wind (which, indeed, seldom blows there, especially in the summer season), let her stand over to the N.W. side of Tenerife, and beat up along shore until she weathers Point Naga;

* The following notice, which appeared in the *Shipping Gazette*, in March, 1840, will be useful to vessels touching at Palma:—"Several English vessels having lately sent ashore their boats at Tassacorte, without receiving the succour they required, I beg, through you, to inform the shipping interest in general, that the orders from the Spanish Government are, that no communication be held, or refreshments given, at any other place, except this and the town of Santa Cruz, on the N.E. side of Palma."—*Canaries*, January 10th, 1840.

thence, with the wind that generally prevails in these parts, she will be able to weather Canaria, and fetch the Point of Handia, or Fortaventura, or perhaps Morro Gable, the southern point, whence it is easy to beat up to Pozzonegro, along the East side of the island, because the sea there is always smooth. It is not quite so easy to beat up from Pozzonegro to the Isle of Lobos; yet it may be done without difficulty, when the weather is moderate; if the wind should happen to blow hard, she may stop in the Bay of Las Playas, until it proves more favourable.

From the Isle of Lobos, she will find no difficulty in beating up to Porto de Naos, in Lanzarote. It is not advisable, for those who are not perfectly well acquainted with that harbour, to attempt to conduct a ship in, because the entrances are very narrow.

It is common for ships that come loaded from Europe to Santa Cruz, Tenerife, &c., to have part of their cargoes to unload at Port Orotava: these ships, when the trade-wind blows hard, will sometimes find it impracticable to weather Point Naga; when this is the case, bear away to the leeward point of the island, and keep near the shore, where, if you do not meet with a southerly wind, you will be carried by the current, in the space of twenty-four hours, from the S.W. point of the island to Point Teno, whence you may easily beat up to Port Orotava; for, when the wind blows excessively strong at Point Naga, it is moderate weather all the way from Point Teno until within 2 or 3 leagues of Point Naga. But I would not advise a ship to bear away as above directed, unless when the trade-wind blows so fresh that she cannot weather Point Naga; because, in moderate weather, there is little or no wind stirring on the coast between Teno and Port Orotava.

The Coast of Africa, East of the Canaries, is level, and is rendered inaccessible by a heavy surf, which breaks on it continually. The Canarians, in the sea between this coast and the islands, employ a number of vessels to fish for bream and cod.

OF THE CALMS OF THE CANARY ISLANDS. (By the same.)

It has been already noticed, in the description of the Island of Canaria, that its mountains tower so far above the clouds, as to stop the current of the N.E. wind that generally blows here; so that, when this wind blows hard on the North side of the mountains, it is either quite calm on the other side, or a gentle breeze blows upon it from the S.W. These calms and eddy-winds, occasioned by the height of the mountains above the atmosphere, extend 20 or 25 leagues beyond them to the S.W. There are calms beyond, or to leeward of, some of the rest of the islands, as well as Canaria; for those of Teneriffe extend 15 leagues over the ocean, the calms of Gomera 10, and those of Palma 30. "I have," says Captain Glas, "been frequently in all the calms of the islands, excepting those of Palma; and, from my experience of them, I may venture to say, that it is extremely dangerous for small vessels, or open boats, to venture within them when the wind blows hard without. It is true, indeed, the wind raises the waves of the sea to a mountainous height: yet those waves follow each other in regular succession; for, were they to fall confusedly one against another, no ship would be able to sail on the ocean. But, in a storm, the wind driving the sea before it, each wave gives place to the one which follows; whereas, in the calms in the Canary Islands, the sea, not moving forward in the same direction with the sea without, but being, as it were, stagnant, or at rest, resists the waves that fall in upon it from without; and this resistance causes them to break just in the same manner as the billows break upon the sea-shore, but with less violence, on account of the different nature of the resistance. This breaking of the waves is only on the very verge of, or just entering into, the calms; for within them the water is smooth and pleasant.

"Upon first coming into the calms, the waves may be seen foaming and boiling like a pot, and breaking in all directions. When a vessel comes amongst them, she is shaken and beaten by the waves, on all sides, in such a manner, that one would imagine that she could not withstand their force; however, this confusion does not last long. The best way to manage a ship entering the calm is immediately to haul up the courses, and diligently attend the braces, to catch every puff of wind that offers, in order to impel the ship into them as soon as possible. The crew must not think it strange to be obliged to brace about the yards every two or three minutes, according as the wind veers and hauls; but, after a ship is once fairly into the calms, she will either find a dead calm and smooth water, or a pleasant and constant breeze at South or S.W. according as the wind blows without, to which this eddy-wind, as it may be called, always blows in an opposite direction."

Remarks made on Sailing from the Canary Islands to the Equator, by Captain Lisiansky, of the Russian Navy, in 1803, and on recrossing the Line, etc., on the homeward Route, in 1806.

"Amongst the many different things deserving the attention of navigators, the sea currents are not the least important. I am, indeed, firmly persuaded that attention to this subject may lead to useful discoveries; and accordingly made it a rule to keep a journal of the daily difference between the ship's course by reckoning and observation.

"From the Canary Islands to the latitude of 6° N., where the variable winds took place, the motion of the sea was towards the S.W. quarter: it then took a N.E. direction as far as 1° 34′ N., when we received the S.E. trade; and then again to the westward, in which it continued until we passed the Equator. On calculating the variation of the current from all the above-mentioned tendencies of the sea, it appears that the *Neva*, in her run from Tenerife to the line, was driven by it about 60 miles to the southward, and nearly the same distance to the westward.

"After having passed the Equator (lon. 24° 9′ W.), the S.E. trade freshened by degrees; and, as we proceeded, veered a little to the East, which was favourable to our course."

On re-crossing the Equator, 11th May, 1806 (lon. 16° 18′ W.), "We had a pretty strong westerly current; but it soon changed to the S.E., and so continued until we reached 9° N. It then took a direction to the S.W., and occasionally to the N.W., pushing us on as far as the tropic, at the rate of 15 miles a day. From the tropic till we had variable winds, it was constantly to the S.W., when it returned again to the S.E., and kept to that point till we made the Western Islands, where we found that, from the line, we had been borne by currents, altogether, 30 miles to the South, and 3° to the West.

"Between the parallels of 21° and 36½° N. we passed, continually, a quantity of sea-weeds, which appeared like large floating islands. These weeds were full of small fish and crabs, of which we caught a great number, chiefly from curiosity."

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6. THE SARGASSO SEA.

We have already described, in general terms, that portion of the Atlantic, which bears the name of Sargasso Sea (see page 208), with its general boundaries. The weed, as already noticed, was met with in large quantities by Colombo; and it is said that the old navigators, *Thevet* and *De Lery*, were fifteen days in passing through extensive fields of it, which they fell in with near the tropic of Cancer.

We cannot at present assign, with certainty, the places of its growth, nor satisfactorily account for its appearance in the situations in which it is found. Sir Hans Sloane, in his *History of Jamaica*, notices, that it has been seen on the coast of Africa, and near the Cape Verde and Canary Islands, as well as on the coast of Hayti: but some of these patches, as we have shown, may have been fields detached from the central beds of the ocean. He has also shown, that a portion of it is carried through the Strait of Florida, and hence it has been called *gulf-weed*.

That it grows at the bottom of the sea, in situations not yet certainly defined, appears to be a fact; yet the assumption of its growing in the *deep* sea has been pronounced, by an intelligent writer, as one quite at variance with the known decrease of temperature at certain depths; and this creates a dilemma with which we know not how to contend, otherwise than by offering the following arguments. It is almost surprising, that a regular examination has never yet been made, by which the question might have been determined, although of no consequence in actual practice.*

* A description of the weed, as written by Mr. Turner, is given in the *Nautical Magazine*, June, 1822, illustrated by an engraving of a very singular fish, from its size and figure called a *toad-fish*, and found among the weed, as well as the little but well-known fish called the *pipe-fish*.

It seems to be generally admitted, that a great proportion of the weed is brought from the Mexican Sea. Captain Livingston, in his way from New Orleans to the Strait of Florida, saw large quantities of it: and every one who has navigated the Gulf Stream has remarked the weed in it, or along its borders. Sir Philip Broke and the Baron Alexander von Humboldt say, that the stream contains a great deal. Sir Philip says, "We were always surrounded with gulf-weed." Major Rennell adds, "He spoke of that part of the Gulf Stream out in the Atlantic: the others might speak of other parts."

In the second volume of the *Colombian Navigator*, 1848, page 220, is a description of the Andros Isles, as lately surveyed, and it is there shown, that in the great sponging district, upon the Bahama Bank, West of Andros, vast quantities of the gulf-weed are produced: and this may, perhaps, be one of the beds from which the ocean has been supplied, as well as that in the Mexican Sea, seen by Lieutenant Evans, in April, 1828, as shown in page 229.*

On the weed found in the ocean, we have the following remarks, by *Captain Livingston*, whose name has so frequently occurred in the preceding pages:—

"Many persons suppose that the gulf-weed (*fucus natans*) grows upon the rocks about the *Bermudas*; others, that it *originates* among the Florida Reefs; and a third party, that it *grows* upon the water, without ever adhering to anything fixed.

"All these positions seem to me equally wide of truth. Neither on the Bermuda *Rocks*, nor among the Florida Reefs, has a single branch of gulf-weed ever been found *growing* upon the *rocks*; and, among all the gulf-weed met on the ocean, no person has *ever found* a single tuft with *roots*, or that, on mature examination, could be supposed, by any person of sound judgment, to have grown on the surface of the water. On the contrary, every stalk of the weed seems to have been broken off short from something to which it firmly grew, and *all the ends* of these stalks are uniformly decayed, or dried up, from the end to a short distance.

"I am of opinion, that the gulf-weed grows in the centre of the immense eddy or whirlpool, formed by the inclination of the water to the westward, caused by the influence of the trade-winds, between the latitudes of about 6° and 22° North, and the Gulf Stream, &c., between the parallels of 22° and 34°; that it *grows on the rocks at the bottom of the ocean*, in the Sargasso or Grassy Sea, in the space comprehended between the 22nd and 34th parallels of latitude, and the 26th and 58th or 60th meridians of longitude, West of Greenwich; that the stalks decaying, or being broken off, by some agitation of the sea, near the roots, the tops rise to the surface of the water.

"It has been stated, as a well-known fact, that the *fucus natans* grows on the rocks along the Gulf of Paria, and on the coasts of Caraccas, &c. If this be the case, it is rather strange that it should not rather grow on other rocks and coasts of the West Indies. It has also been stated, that in the whole sea of floating bushes, *Mar do Sargasso*, not a withered plant is ever discovered. This is not true, as I have seen abundance of the *fucus natans* in a state of great decay. I note the following, from my journal of the *Brilliant*, from Gibraltar toward Havanna: 8th February, 1819, 'the weed much decayed;' 9th, 'weed passed through, a.m. much decayed;' 10th, p.m. 'passed through much decayed weed; I remark, that the farther we run to the westward, the more decayed is the gulf-weed;' 13th, 'the gulf-weed begins to look fresher.'†

"These particulars have been given, in order to show that I have not spoken at random, but, on the contrary, actually made my remarks on the spot. Some of the weed was quite brown, and in small fragments, evidently separated into such by its state of decay. It is true, that the weed soon decays when it is taken out of the water, as I have often tried the experiment. The weed is never of a verdant green colour, but seems as if blanched from having been, in some degree, hid from light: I suppose from vegetating under water."

* "On the outer passage to Vera Cruz we met, for the first time, with the sea-weed, in lat. 33° 55′ N., lon. 16° 20′ W., and on the homeward passage, the last piece in 43° 51′ N., and 43° 20′ W. The latter on the northern edge of the Gulf Stream.—*J. Evans, Lieut. R.N.*

† On the 8th of February, the *Brilliant* was in 24° 17′ N., and 65° 1′ W. On the 9th, in 24° 34′ N., and 66° 50′ W. On the 10th, in 24° 51′ N., and 68° 39′ W. On the 12th, in 25° 34′ N., and 71° 5′ W. On the 9th, the ship passed the meridian of Porto Rico, and was hence proceeding toward Providence Channel, Bahama. The decayed weed, we have no doubt, had drifted from the central bed of the ocean.—Ed.

Let us now read what the Baron Humboldt says upon the same subject.

"From the depth of about 30 fathoms, in the channel, between Clara and Allegranza, to the northward of Lanzarote, a curious species of sea-weed was brought up from the bottom of the sea: the stem of a brownish colour, and 3 inches long; had circular leaves, of a *tender* green, with lobes, and indented at the edge. The vine-leaved fucus," he adds, "presents a phenomenon of great interest; fixed to a piece of madrepora, this sea-weed vegetates, at the bottom of the ocean, at the depth of 192 feet, notwithstanding which, its leaves are as green as our grasses.

"Mr. Turner, who has so well made known the family of the sea-weeds, and many other celebrated botanists, think that the greater part of the *fuci* (weeds) which we gather on the surface of the ocean, and which, from the 23rd to the 35th degree of latitude, and 30th of longitude, appear to the mariner like a vast inundated meadow, grow primitively at the bottom of the ocean, and float only in their ripened state, when they are torn off by the motion of the waves.

"To the North of the Cape Verde Islands, we met with great masses of floating sea-weeds. They were the tropic grape, *fucus natans*, which grows on submarine rocks, between the Equator and lat. 40°, both North and South. I am assured, from the comparison of a great number of journals, that, in the basin of the Atlantic Ocean, there exist two banks of weeds, very different from each other. The most extensive is a little to the West of the meridian of Fayal, one of the Azores, between lat. 25° and lat. 36°. The temperature of the ocean, in these latitudes, is from 61° to 68°; and the North winds, which sometimes reign there very tempestuously, drive floating isles of weed even to the parallels of 24° and 20°. The vessels which return to Europe, either from the Rio Plata or the Cape of Good Hope, cross these banks, which the Spanish pilots consider as at an equal distance from the Antillas and Canaries. The second bank of fuci (weed) is but little known; it occupies a much smaller space between the 22nd and 26th degrees of latitude, 80 leagues East of the meridian of the Bahamas. It is found on the passage from the Caycos to the Bermudas. In the latitudes just described, the fuci, far from being fixed to the bottom, float in separate masses on the surface of the water. In this state the vegetation can scarcely continue a longer time than it would do in the branch of a tree torn from its trunk; and, in order to explain how moving masses are found, for ages, in the same position, we must admit, that they owe their origin to submarine rocks, which, placed at the depth of 40 or 60 fathoms, continually supply what has been carried away by the currents. *It is not the Gulf Stream, as some mariners think, which accumulates the fucus to the South of the Azores.*

"It were to be wished, that navigators would heave the lead more frequently in the latitudes covered with weeds.

"The causes that unroot these weeds, at depths where it is generally thought the sea is slightly agitated, are not sufficiently known. It has been said, that if the fucus adhere to the rocks with the greatest firmness before the display of its fructification, it separates with great facility after this period, or during the season which suspends its vegetation, like that of the terrestrial plants. The fish and the molluscæ, that gnaw the stems of the sea-weeds, no doubt contribute also to detach them from their roots.

"On proceeding hence, toward the West Indies, from the 22nd degree of latitude, we found the surface of the sea covered with flying fish, which threw themselves up into the air 12, 15, or 18 feet high, and fell down on the deck. I do not hesitate to speak of an object, of which voyagers discourse as frequently as of dolphins, sharks, sea-sickness, and the phosphorescence of the ocean. None of these objects can fail of affording interesting observations to those who make them their study."

The *fucus natans* is found in localities to the *eastward* of the Sargasso Sea, and it may be a question whether it is carried by the currents from a western origin, or whether it grows on the shoal which extends so far off the land, between the Gambia and Sherboro Island. It probably exists in abundance in the vicinity of the Bissagos. For the following communication concerning the gulf-weed, we are indebted to Captain *Thomas Midgley*, and it is a great acquisition to our knowledge of the wide range that this plant has:—

"On my outward passage to Africa in a perfect calm, at daylight of the morning of 18th of January, 1841, in lat. 6° 46′ N., and lon. 14° 56′ W., I found the ship amongst a number of small bunches of weed, and many cuttle-fish shells.

"On carefully examining some of the bunches of weed, I was surprised to find it the

true *fucus natans*, or Sargasso or gulf-weed, being, in every respect, precisely the same as that found in the N.E. trades, but apparently much fresher, having exactly the same kind of oblong, narrow, serrated leaf, same stem, same nodules, and just the same pale yellow colour. The pods were also surrounded with a very fine kind of net-work, and there were a very few minute barnacles attached to the stem, which scarcely showed any marks of decay; indeed, the two bunches brought on board (which were each about 4 inches in diameter) appeared to have been but very recently separated from the parent stem, and they each contained a small, but very lively, crab.

"The lively fresh appearance of the weed, and the two crabs, induced me to try for soundings, and, as the weather was perfectly calm and the water smooth, I was enabled to get a perpendicular cast of 112 fathoms, with a well-armed heavy lead, but found no bottom.

"The weed was in detached and small bunches, and could only have extended over a comparatively limited space; for when a breeze of wind sprung up, and the vessel had sailed 20 miles to the eastward, there was not a single sprig or bunch to be seen.

"This weed appears to be unknown upon the Krou coast, for I had two intelligent natives of Sangwin and Grand Sestros on board at the time I picked the weed up, and they severally declared they had never seen it upon any part of the coast.

"The vessel had been perfectly becalmed for fourteen hours previous and two hours subsequent to the time of picking up the weed, so that she gradually drifted amongst it by a current, which I found, by good observations, and carefully-kept reckoning, to set E. by S. by compass, very nearly three-quarters of a mile per hour. Temperature of water, when weed was picked up at daylight, 79°, and at noon, 81° Fahrenheit."

Mr. Luccock, in his *Notes on Brasil*, has likewise described the *Green* or *Weedy Sea*. He states that it extends from 11° to 35° of North latitude, and from 30° of longitude, to an indefinite distance westward. "Here," he says, "the ocean is covered by nodules of sea-weed, from 3 to 18 inches in diameter, somewhat resembling, in form, a cauliflower when stripped of its leaves. They float lightly on the water, in parallel lines, at a very few yards from each other, and have a yellow-brown colour, like the long stringy fibre which is sometimes seen floating in the English Channel, and which I suppose to be the natural colour of all marine plants, growing deeply beneath the surface of the water. These nodules, or spherules, are composed of a vast number of small branches, about half an inch long, which shoot from each other at an angle of about 40°; hence they multiply continually toward the superficies of the sphere; and each extreme point produces a round seed-vessel. This is little more than one-tenth part of an inch in diameter, is hollow, and contains a small reddish-brown seed, scarcely occupying one-fifth part of the husk. The leaf of the plant springs from the joints of the branches, is oblong, indented at the edges, about 1½ inches long, and a quarter of an inch broad.

"When the nodule is dexterously taken up, all the branches may be traced to one principal stalk; and this invariably shows a fracture, the part by which it has been joined to some larger stem. This fracture is frequently quite fresh, and, in large and vigorous plants, shows distinctly a woody part and a cortex. On the edges of the latter, the first symptoms of decay appear. They become brown, and separate themselves from the wood. This also then assumes a darker colour, and exhibits the regular process of disorganization, just in the same manner as does a slip from a currant or gooseberry bush. In process of time, the whole of the plant assumes a darker hue; and, as it decays, floats considerably lower than it did. When kept out of the water for a few hours, it becomes harsh and brown, and acquires the peculiar smell of marine vegetables in a state of putrefaction.

"Sailors say, that this weed grows in the Gulf of Mexico; that it passes round Cape Florida with the stream; and, proceeding between Bermudas and the Western Islands, settles in the eddy of that vast current which encircles the Northern Atlantic. To me, however, this hypothesis appears to be inadmissible, not only because here is an evident absurdity in supposing that plants may move rapidly in a still water, which the word eddy here must signify, but because it is impossible for the floating body to move faster than the current does, and in a direction different from the set of the water. By every observation and inquiry which I have had an opportunity of making, no uniform current has been found to exist, capable of carrying the nodules in the direction specified, and to parts of the ocean where they are found; and no one, I think, who has considered the subject, will contend that there can be one capable of conveying them through a course

of 4,000 or 5,000 miles, before the plants show symptoms of decay. In this case, too, *the most vigorous plants must be found on the northern verge* of this sea, and the most decayed ones toward its southern limit, which is, indeed, *directly contrary to fact;* for, in the latitude of 11° North, we meet with slips which bear evident marks of being recently torn from their parent stems, and the seed-vessels there are often unusually fresh and flourishing; while on the northern borders we sometimes find them perishing, and even decayed; neither of which cases could occur, if the plants floated southward.

"It is more reasonable to suppose that the plants grow nearly on the spot over which they float; that those which appear on the surface of the water are only the heads, or minor branches of others, which flourish beneath; that they are broken off by the agitation of the ocean, or some other accidental circumstance, perhaps by the buoyancy of the seed-vessels themselves, which, at a great depth, must be fully sufficient for the purpose, as it enables them to float lightly, even on the surface of the water. There the plant is exposed to the sun, the seed ripens, the pod bursts, and the contents descend again to form new plants, while the old ones decay, and furnish manure, according to the established economy of nature among vegetables, both terrestrial and aquatic.*

"A great number of very minute barnacles are found upon the leaves and stalks. The seed-pod is usually enveloped in a sort of honeycomb work, which may be taken from it, and, when examined by a lens, resembles, in appearance, the net-work in a fly's eye. Its substance, I conjecture, is coralline. Among other inhabitants of the plant, is frequently a number of small crabs, perfectly formed, and evidently young, yet vigorous and active; and when a nodule, taken fresh from the water at night, is hung up in a small cabin, it emits phosphorescent light enough to render objects visible.

"The singular arrangement of the plants, in parallel lines, is evidently owing to the wind, whose direction they always observe. Each nodule places itself under the lee of its more windward neighbour, and thus observes the law of floating bodies when exposed to a current of air. Should the wind suddenly change, as it sometimes does, a point or two, in this part of the Atlantic, and blow strong, these lines become broken, and form what are commonly called *fields of weed.* These, however, are generally small, and seldom, I suspect, remain long so disarranged.

"In the month of October, I have run with a fine schooner, due North, through the N.E. trades, in the longitude of 26°, and found no weed, being perhaps to the East of it. In the month of March, on board a different vessel, we formed a diagonal line, from 26° to 44° West, across the parallels from 11° to 44°, and saw a great quantity of it. In May, of another year, along the same track, there was much less observed; yet I dare not say that these dates are sufficient to point out the season of ripening, maturity, and decay of the plant, although I have never taken up a nodule which was not full of seed-pods, and never heard of a person who had noticed one destitute of them. It is said, that whales come down to the vicinity of Bermuda, at a particular season, and feed upon these plants; yet I do not recollect ever seeing an individual of that species in the Weedy Sea; but, on the contrary, have noticed a deficiency of fishes in general; and most, if not all, of those which I have seen opened on board, appeared to live, not upon vegetable food, but their fellow-inhabitants of the waters. It is probable, however, that none but such will take a bait or approach a vessel."

* "It is certainly remarkable," says Captain *Martin White,* "that the *loci natales* of the *fucus natans* (spread, as it is, among the other *rejectamenta* of the sea, so profusely over the Atlantic, Indian, and Pacific Oceans), should have remained so long undiscovered; we are informed, however, that *two* varieties have been found in the Red Sea, and a solitary specimen has been produced by Dr. Wright from the West Indies, another by Guinnani from the Mediterranean; but without any remarks as to the *soil* it grew upon, or the *depth* of water where taken, both of which are very important. It is stated, also, to have been received from Bermuda, and to have been seen on the rocks along the Gulf of Paria, and on the coast of Caraccas; but, if the latter were so, would it not be also found on the coasts contiguous? I do not presume to question the fact of the *fucus natans* having been received from Bermuda; nevertheless, I have often heard surprise expressed at not finding this weed growing among the rocks at that island, and still more at its absence from the anchorage eastward of New Providence, where, to my knowledge, the water is so clear as to render it quite possible to distinguish the varieties, even under the ship's bottom."—*Remarks on the Winds, the Tides, and the Currents of the Ocean,* p. 144

7. THE CAPE VERDE ISLANDS.

The CAPE VERDE ISLANDS derive their name from the nearest point of the coast of Africa, and consist of the Ilha de Sal, or Salt Island; Bonavista; Mayo, or the Isle of May; St. Iago; Fuego, or Fogo; Brava; St. Nicolas; Sta. Lucia; St. Vincent; and St. Antonio; besides several small islets. Of these isles, the most considerable is St. Iago, the chief town of which is the seat of government. The population has been estimated at 42,000 persons. Salt is the principal article of commerce.—*For the positions of the chief points, see page 55.*

We have already shown (pages 269 and 271) the usual courses and allowances to be made in sailing to these islands; and have there noticed the fogs by which they are frequently surrounded. The estimated limits of the N.E. trade-winds, in the vicinity, may be seen in pages 121 and 126. Thus much premised, we immediately proceed to the description of the isles.*

ILHA de SAL, or SALT ISLAND.—The Isle of Sal lies between lat. 16° 34′ and 16° 51′. The meridian of 23° W., according to the late survey, passes through the middle of it. The northern part of the isle is mountainous; the southern very low and sandy. Both the eastern and western sides are irregular; and the former has an almost continued reef, along-shore, from North to South.

SAL derives its name from the salt-ponds upon it, wherein the water crystallizes into a beautiful salt, the chief production of the isle, as the land is so barren as to bear no trees nor verdure, excepting a few inconsiderable shrubs.

On approaching the island from the North, it will be found, in general, that the currents are very irregular. You may, on approaching, see the high land at 14 leagues off; sometimes at a greater distance. The land makes in three hillocks, of which the northernmost is the highest. This is the *Peak of Martinez*, in the N.E., the summit of which is 1,340 feet above the level of the sea.

The best roadsteads of Sal are on the western side of the island; but there are three little bays on the eastern side, and one on the South. The middle bay on the eastern side, where a ship may lie, is apparently sheltered from the N.E. by a sandy reef stretching out to the eastward, and here salt may be obtained.† The other bays on this side are open to the N.E. trade-wind, which makes a very heavy sea on the beach.

Great caution is required on approaching the South end of the island in the night, it being so low as hardly to be seen 10 miles off in the day. Keep your lead going, and

* Mr. Finlaison has said that, "In leaving Tenerife for the Cape Verde Islands, you will certainly have the wind from E. by S. to N.E as you approach the islands." He also adds, that, in the passage, a current was generally found setting *from S.S.W.* at the rate of half a mile an hour, which is contrary to the current on the African coast.—(*See page* 218.)

CAPTAIN OWEN has noticed that, in 1822, H.M.S. *Leven*, in shaping a course from Tenerife for the Cape Verde Islands, steered S.W. ½ W., being half a point more to the westward than the course should have been, had the compass been uninfluenced by the local attraction of the ship, or "by what is called deviation [we say *aberration*]." The *Barracouta*, at the same time, shaped hers without regard to this deviation, which in her was full one point on the S.W.: the consequence was, that she was carried considerably to the eastward of her direct course, which prevented her reaching Sal until two days after the arrival of the *Leven*. "This is mentioned," says Captain Owen, "to show the probability that many of the extraordinary currents said to be found in the ocean do not exist; or, rather, that the discrepancies between the observations and dead-reckoning may as frequently be attributed to the unthought-of deviation of the compass as to other occult causes."

But we are inclined to think, that, in the instance cited, there must have been a *compound* error: due allowance not having been made either for current or aberration. But from the number of wrecks that have occurred on the N.E. side of Bonavista, giving rise to the reports of several rocks in various situations, it must be inferred that the *general* tendency of the currents on this track are to the westward and southward.—See the description of Bonavista and the Hartwell Reef hereafter.

† *Firestone Hill.*—A promontory, on the eastern coast, stands at 2 leagues from the North Point. At the back of this is the Salt-pond Hill, a natural curiosity, as upon this is the salt pond, 150 feet above the level of the sea. The surface of the pond, in a circular form, is 45 feet below the top of the hill.

approach no nearer than in 30 fathoms, unless bound into the *South Bay*, which lies between the S.E. and South points of the island.*

The S.E. point of Sal is now called *Wreck Point*, H.M. sloop *Erne* having been wrecked near it in 1819: this is surrounded by a reef. From *South Point*, forming the West side of the bay, a dangerous sandy spit extends about 1 mile into the sea. If coming into the bay between these points, after rounding Wreck Point in 8 or 9 fathoms, bring that point to bear E. by S. and the opposite point W. ½ N., and anchor in 9 fathoms, sandy bottom. Here you will be sheltered from the N.E. trade, and lie in perfect safety.

At 5 miles to the West, from the *North Point* of Sal, is *Manuel* or the *N.W. Point*. Nearly true South, 8½ miles from the latter, is a little islet, called *Bird Isle*, near a promontory, *Lion's Head*, which is 620 feet high. At a league to the northward of Bird Isle is a small bay, called *Palmyra Bay*, and immediately to the south-eastward of the Lion's Head is *Mordeira Bay*, which is one of the best in the Cape Verde Islands.

MORDEIRA BAY is in a semicircular shape, 1 league in extent between its outer points, *Lion's Head* and *Turtle Point*. It is a safe anchorage during the N.E. breezes. Captain Bartholomew says, that it has plenty of fish and turtle, but has no watering-place; nor could water be procured by sinking casks in the sand.

H.M. ships *Leven* and *Barracouta* anchored in this bay in 1822, and caught a great many most delicious fish: yet the place produces little else but salt and orchilla; a few goats contrive to pick up a scanty subsistence, but eagles abound.

The principal mark for anchoring in Mordeira Bay is Bird Island just shut in with the foot of Lion's Head, at 1¼ miles from the Bluff land: there are several foul spots; therefore, the ground should be examined before the anchor be dropped.

From Turtle Point, the South point of Mordeira Bay, to the South point of Sal, the distance is 1½ leagues. The ground between is smooth, and has 7 fathoms over it, at half a mile from shore, which is sandy; but be careful, if you anchor, that the ground is clear. In rounding the South point, with the spit extending from it, approach no nearer than in 10 or 8 fathoms, as the latter is steep.

The latitude of the Lion's Head, according to the late survey, is 16° 41′; lon. 23° 0′ 15″. *Variation*, observed on shore, 15° 20′ W. High water, 7^h 15′; rise, 5 feet.

Between Sal and Bonavista, there is generally, a strong current.

BONAVISTA.—The Island of Bonavista, properly *Boãvista*, or *Good Sight*, has been so called from the beautiful appearance it made to the first discoverers, in the year 1450. The face of it is variegated; partly low, partly rocky and mountainous; formerly fertile, now more barren. Salt is the principal article of trade, which the inhabitants readily exchange for old clothes, biscuits, meal, and raw silk. The principal place is ENGLISH ROAD, on the N.W.

The town consists of only 40 or 50 houses, rudely constructed, and mostly of negro architecture. The colour of the inhabitants is from white to negro jet, comprehending all the intermediate shades; and they are so intermarried, slaves excepted, that they may be considered as one family. The population of Bonavista, in 1822, was said to be about 3,000, of whom 300 were regular soldiers. Pigs, goats, sheep, and poultry, may be had here, but all are lean, and of inferior quality.

The eastern side of Bonavista is partly environed by a reef; and on the N.E. are the reefs on which the *Hartwell*, East Indiaman, was lost, in 1787; and on which the *Resolution*, Captain Cook, was nearly driven by a southerly current. Half a league nearly from the West end is a coral reef, on which the sea breaks; and, at times, the current sets on it very rapidly.

From the South end of Sal, the N.W. point of Bonavista lies *true* South, or S. by W. ¼ W. by compass, distant 7 leagues; and, from the same end of Sal, to clear the N.E. reefs, the course, by compass, is S.E. by S. 11 leagues, in order to allow for the current that sets to the S.W. on Bonavista: be sure to make this course, and it will bring you to the eastward of these reefs, the easternmost part of which lies in lat. 16° 10′.

* Hearkening for the noise of the surf will often give ample warning in approaching land, either during a fog or by night, and ought to be attended to, if heard; but no one ought to run rashly, making certain of hearing it.—*A. L.*

Bonavista is of an irregular shape, but nearly octagonal, and each way 3 leagues in extent. Its eastern side is low, but the interior is mountainous, and a ridge of high land from N.W. to S.E. divides the island into two unequal parts. Of this inland chain, *Mount Juan Fernandez* is the northern part, and the southern is called the *South Mountain*. Two miles from the N.E. end is another eminence, *Mount Ochel*, or *Ochello:* at the N.W. end is the *Peak Reshee*, and in the S.W. is the *Platform Hill*, with an elevation within it, called the *Man Mountain*. *English Road*, on which the town is situate, forms a bay 5 miles in extent from N.E. to S.W., and its northern part is protected by an islet, called by the English *Small Island*. The South point of this bay is *Coral Point;* and off this point, which is foul, at the distance of half a league, is a coral reef.

Off the N.E. coast, as already shown, are the Hartwell Reefs, and three kays, called *Dutch*, *Braithwaite*, and *North*, *Kays*. Between these is sufficient depth of water for ships, in case of necessity, and proper depths for anchorage, under the lee of the reefs; but many rocks are here scattered, with only 12 or 13 feet over them, and 4 fathoms close along them, on which, with a wind, the sea breaks very high. Of the channels between these reefs, the best lies between a ledge to the E.S.E. of Braithwaite or the Middle Kay, which is always visible, and Dutch or the South Kay. This channel is three-quarters of a mile broad, and has regular soundings, from 15 to 5 fathoms; having been tried by H.M. sloop *Bulldog*, which often sailed in and out of it, and several times anchored under Braithwaite Kay, with that kay N.E. by E., Dutch Kay S. ½ W.

Braithwaite Kay is about 2 miles from the shore. The passage to the north-westward, between this and North Kay, is half a mile broad, and its least water is 7 and 8 fathoms. The passage between Dutch Kay and Bonavista is narrow, but in the best water are 7 fathoms. Dutch Kay bears from Braithwaite Kay S. ½ W. [*S. by E.*] 2½ miles.

The *North Kay* is connected to the shore by a reef, having over it only 5 feet of water. When this kay is in a line with the summit of Mount Ochel, or the N.E. high mountain in Bonavista, it bears about W.S.W. ½ W.

In sailing out to the south-westward, with the wind easterly, stand well to the southward, taking advantage of the current here setting easterly, and take care not to borrow too near the back of the reefs.*

* A ship, the *Madeline*, bound to New South Wales, was reported to have struck and been wrecked on a reef, at about 8 leagues E.N.E from Bonavista, in April, 1835, as shown in the "*Nautical Magazine*," February, 1837, and "*Brazilian Navigator*," 1838. Some smart but justifiable remarks upon this report have since been given in the "*Nautical*" (December, 1839), the writer of which represents the case as a matter "very nicely cooked up for the edification of seamen," and the benefit of a certain "market." He adds, that Captain Vidal has, by his researches in the *Ætna*, satisfactorily proved that no such danger as the Madeline or Bonetta Reefs have any existence.

These imaginary dangers have also been sought for by the American exploring squadron, as shown hereafter, and the result seems to be, that the *Madeline* was impelled to the S.W. by the current, and wrecked on the *Hartwell Reef* of Bonavista. The tracks of the *Ætna* and *Raven*, in search of the two reefs, are shown in a chart prefixed to the *Nautical Magazine* of December, 1839, above mentioned.

Notwithstanding all the investigations that had been made, and which might have been considered as having set the question at rest, of the non-existence of the Bonetta and Madeline Reefs, a notice was given, that the British ship *Charlotte* was wrecked, April 18th, 1841, on a reef 23 miles N.E. by E. from the N.E. end of Bonavista. In a subsequent discussion on the *Charlotte's* log, in the *Nautical Magazine*, the conclusion is again arrived at, that it was a portion of the Hartwell Reef on which she was lost. In July, in the following year, the *Phœnix* steamer struck on a rock, which was declared to be the Sunbeam Shoal, and the same on which the *Charlotte* was lost (*Times*, August 2nd, 1842); but this also is found, from her log, to be inconsistent; and that it must have been the Hartwell Reef. Since that, the iron ship *Guide*, belonging to the East India Company, has been wrecked on the Hartwell Reef (7th March, 1843), and went to pieces; and on September 20th, 1844, the brig *Nine* from Newcastle, outwards, was totally lost on the same place. The long list of wrecks, and the fact of so many vessels being to the *westward* of their reckonings, and that in the short run from Madeira or the Canaries, will give great weight to the fact of the westward tendency of the currents, which, as has been stated before, tend directly towards this formidable danger, and therefore will call for all the vigilance and care so imperatively necessary for the safety of ships passing this place.—See *Nautical Magazine*, August, 1841, p. 56; December, 1841, p. 816; January, 1842, p. 45; September, 1842, p. 644; November, 1842, p. 753; and July, 1843, p. 493.

The *Brazen Hill* and *Point* (otherwise *Brazen Head*), in lat. 16° 2′, on the S.E. coast, is the first high land to the southward of *East Sand Head*, which is the easternmost point of Bonavista. The Head is remarkable, being very bluff and perpendicular on each side. The beach is sandy. The *South Point*, which is nearly 3 leagues more to the south-westward, is low and foul, and an islet, of the same description, lies at three-quarters of a mile to the eastward. To the westward of the point is anchorage, in what is called *Portuguese Road*, with the Platform Hill bearing about N.N.W. and nearer in-shore, in from 13 and 14 to 8 and 6 fathoms. In the latter depths, the landing-place will bear N.E. by N. more than a mile distant.*

North and West Coasts.—From the *North Kay*, off Mount Ochel, already described, the coast is foul to *Broyal Point*, on the North coast; and there are several reefs between the latter and the N.W. end of the island, which is called the *North Point and Reef*. Small Island, which forms the N.W. side of English Road, is 4 miles hence to the S.S.W. [*S. by W. ¼ W.*]

English Road is a safe anchorage during the summer months, while you have the N.E. breezes, but there are three reefs in it, as shown on the new charts. Vessels generally haul close round Small Island, in 6 and 7 fathoms, and pass within the first reef (of 10 feet) in order to avoid the necessity of making a tack to get to the anchorage. The best mark for the latter is, the town open with the N.E. end of Small Island, and the highest part of that isle about N.E. by E. The Ten-feet Reef generally shows itself; but when this is not the case, a stranger will do well to stand outside, rounding it at about 1½ or 2 miles from Small Island, approaching it no nearer than in 6 fathoms, and, after once opening the town, taking care not to shut it in again.

The new town is on the middle of the bay, and the second reef (*New Town Reef*) lies to the westward of it, at a short distance from the beach. The *Inner Reef* lies, in like manner, half a league more to the northward. The Ten-feet Reef is about 100 fathoms in length, and extends nearly East and West, at rather more than a quarter of a mile from Small Island.

Mr. Keilor has said—"We experienced, in a calm, a very large sea, breaking in every part of the bay, and were, at the same time, riding with a very short scope of cable, by reason of a strong current setting out of the bay, against the sea: this current runs so high as to frequently break on the deck."

In the rainy season, which is during the months of July, August, and September, the Island of Bonavista is subject to light airs and changeable winds, with heavy swells in the bay and roadsteads.

The tide flows, in English Road, at half-past two, on full and change days, and the sea rises 5 feet. Observe that there is no fresh water for shipping at Bonavista. There is water, but not plenty of it, near the Portuguese Road.

LETON ROCK, or John Leton's Rock, a dangerous reef, lies, as shown in the Table, p. 55. This shoal has heretofore been variously represented, and described as just even with the surface of the sea, which breaks upon it with great violence. The bottom about it is rocky, and swarms with fish. Its extent from North to South is about a mile.

From the centre of the reef, the North point of Bonavista bears N.E. ¼ N. [*N.* 26° *E.*] 9½ leagues, and the South point of the same E. by N. [*N.* 64° *E.*] 7 leagues.

The lamentable wreck of the *Lady Burgess*, East India ship, one of the outward-bound fleet of 1806, was caused by striking on the Leton Rock. This ship struck among the breakers on the rock, at two in the morning of the 19th of April, 1806. The *Alexander*, *Sovereign*, *Lord Nelson*, and other ships, narrowly escaped. The *Lord Melville* struck three times, and slipped off the rock into 25 fathoms, at the time the *Lady Burgess* was standing directly among the breakers. It appeared, from the observations subsequently

In another part of this work we give an announcement made in 1845 of the discovery of a shoal by the brig *Emily* of London, very nearly in the position of the presumed Bonetta Rock, or 16° 59′ N., and 21° 30′ W., which position *was not passed within* 17 *or* 18 *miles* by Captain Vidal, in his search for it in 1839. We scarcely know what to decide on this.

* Mr. Finlaison says, that it is requisite to give the point under Platform Hill a good berth, as there is a reef extending from it. In the day, you may see the sea breaking on it. The mountain E.N.E. clears the danger.

made, that the Leton Reef is composed of coral; no part above water. Captain Swinton, of the *Lady Burgess*, conjectured that the extent on which a ship would strike is not above a cable's length, and that there are no breakers on it in fine weather. To the northward, it appeared to be steep-to.

This danger appears to be on the central part of an extensive bank of coral soundings, extending 4 or 5 miles to the southward, and considerably to the eastward and westward. At daylight, the ship *Asia* was in 52 fathoms, coral bottom, when the breakers and wreck bore E. by N., about 4 miles distant. Other ships had soundings of 25 to 50 fathoms to the West and S.W. of the reef, at from 2 to 5 miles from the breakers. Immediately after striking, the *Lord Melville* had 25 fathoms, its head being to the eastward; shortly after, 30 fathoms. This ship hove-to, with her head easterly, until daylight, and had from 30 to 40 fathoms, all coral soundings. Others had soundings 10 or 12 miles to the southward of the reef, generally coral, sometimes intermixed with sand and shells, and not less than 20 fathoms. The mean of the observations and chronometers of the fleet gave 15° 49′ N., and 23° 14′ W., as the situation of the reef, which is on the meridian of the Isle of Mayo: its situation, according to the late survey, is 15° 48′ N., and 23° 13′ W.

ISLE OF MAYO.—This island is raised considerably above the sea, but a great part is level, excepting three inland mountains of considerable height; but these show as hummocks, and are not conspicuous. On the S.W. side is a sandy bay, called English Road, within which is the town and extensive salt-pans. The soil of this isle is generally dry and unproductive, and there is but one spring of water in the island. The coast is, however, plentifully stocked with fish, which supply, with a few vegetable productions, subsistence to the poor inhabitants.

From the S.W. end of Bonavista to the Island of Mayo, the course is S.W. by S., distant 15 leagues; Mayo is about 4 leagues in length from North to South, rising most toward the middle. On approaching the island from the S.E., the appearance is very different; you may descry, in the North part, two hummocks, which appear like two islands; but, when nearer, the land is perceived by which they are connected. Southward of these is a mountain (*Monte Mayo*), with very low ground to the South, over which two hillocks are seen.

At half a league from the middle of the North side of the island is a reef extending N.N.E. and S.S.W. three-quarters of a mile, which must be cautiously avoided.

In English Road, ships may anchor in 7 or 8 fathoms of water. The landing is very indifferent, no good water to be had, and the place is quite defenceless. The shore to the eastward of and abreast the town is steep, bluff, and rocky; but, to the westward, a low white sandy beach extends to a rounding point, from which a spit of sand and coral stretches outward, at a short distance from the extremity of which there is no ground at 45 fathoms. The spit may be rounded in about 16 fathoms, and a ship should not anchor farther out than in that depth, the edge of the bank being steep. At half a mile West from the town, there is anchorage in 12 fathoms, latitude, according to *particular plan*, 15° 6′ 10″, lon. 23° 15.′ By general chart, 15° 7′ 30″ N., and 23° 17′ W. Variation on the shore, 15° 16′ W., 1819.*

ST. IAGO.—Ships running from Bonavista to St. Iago, and being obliged to ply to windward during the night, must be cautious how they approach Mayo, on account of the reef, before mentioned, off the North point of that island; having doubled that point, they may steer S.W. to make the land of St. Iago, and thence southward until they make the Road of Praya, the common place of anchorage.

The land of St. Iago is very high, and the eastern coast is bordered with rocks, lying very near the land, along which you may sail very safely, at the distance of 2 miles. The S.E. part appears as a long low point, when you are to the northward or southward of it; and, from this point *S.W. by S., true*, about 6 miles, lies the East point of Porto Praya. Between the two, and near the former, lies a bay, which so much resembles that of Port Praya, that many vessels, deceived by the likeness, have run the hazard of being lost in this dangerous place: at the bottom of it are several cocoa-nut trees, and a few houses. The land between this and the point of Port Praya is mostly perpendicular, appearing,

* For Captain Mudge's Remarks on the Magnetic Influence of Mayo, see Note 2, p. 55. The variation, as found by Captain FitzRoy, in 1832, was 16° W.

in some places, like the *Berry Head*, in Torbay; and though the fort of Port Praya, which stands on a small cliff, is a mark by which the true bay may be distinguished from the false one, yet the surest mark is, that the North or East point of the false bay is surrounded with breakers; whereas the point of Port Praya is high, steep, and free from shoals: you must haul close round the point, and keep within a cable's length of the shore to go to the anchoring-place. It may, also, be noticed that there is now a naval signal-post on the cliff, at half a league to the northward of the entrance of Port Praya.

PORT PRAYA is a fine bay, which lies between two points, bearing from each other *W. by S. and E. by N., true*, about 1½ miles. As you sail round the East point, you will soon open the forts at the bottom of the bay, to the westward of which, in a valley, are several cocoa-nut trees and a small house.

The winds, except in the tornado season, are generally in the N.E. quarter, and frequently blow fresh and squally; there are, also, frequent puffs from over the high land; therefore, as you haul into the bay, it is necessary to have the top-gallant sails furled, and to take one reef or more in the topsails. The cliffs, from the East part of the fort, are those above described: you may easily sail within a cable's length of the East land, where you will have 7 or 8 fathoms of water, and, in many places, see the ground at that depth.

On the western side of the bay lies a small black island, called the *Isle of Quails*, or *Frenchman's Island;* it is almost even to the top, but rugged at each end, and some rocks lie off each end to about half a cable's length: there is also a rocky ledge off the North end, where the water is, in general, shallow; you will not have more than 3 fathoms of water between this and the fort; inside, or to the westward of the island, it is navigable for boats only.*

Captain Grant, in the relation of his voyage to New South Wales,† has stated that, "After rounding the S.E. point of St. Iago, there is a small bay to the East, about 4 miles, called by the inhabitants after St. Francis. This bay," he says, "may be always known by its having, at the back of it, and nearly close down to the water's edge, a high flat-topped table-land, standing between two mountains, which cannot be mistaken. Port Praya has, at the bottom of it, besides the house already mentioned, a long, low valley, running inland to a considerable extent, the mountains behind which are sharp and peaked. Near the landing-place there are two remarkable forts on the East side, which you must open before you come to anchor, and on the West side is Quail's Island, which is readily seen as you enter. But the surest mark is that, from the S.E. end of the Island of St. Iago, the shore is low and rocky in general, until you reach the Bay of St. Francis: thence to Port Praya the shore is of high clayey cliffs, which round into the harbour, forming the East side of it.

* ST. IAGO was visited by H.M. ship *Bustard*, in 1825, when the following remarks were written by the master, *Mr. Edward Dunsterville:*—"This island, bearing W.N.W. ½ W. 8 leagues, appears very high. *Mount St. Antonio*, rising out of its centre, is of a conical form, and terminates in a peak, which peak, bearing N.N.W. (by compass) leads to Port Praya Road; and, as you advance westward, you will see the East end, which is very low. As a further guide, you will see an opening, several miles north-eastward of the harbour, on *Signal-post Hill*, which gradually slopes to the westward; also *Red Hill*, which is on the larboard side of the bay, N. by W.

"The town is situate on an eminence rather high, and perfectly white, the houses being visible from S. by E. to S.W. by W.

"In sailing into the bay, keep well to the eastward, as the ground to the westward is foul. Anchor in from 10 to 7 fathoms, with the Red Hill W. by N., outer eastern Entrance E.S.E. Latitude of the anchorage, 14° 53′ 10″.

"A heavy swell sets into the bay and the prevailing winds are from N.E. to East. On the 22nd of October the weather was sultry, with heavy rains. Fruit, cattle, and water may be obtained here. The two latter not very good. The watering-place is at the back of the town, and at some distance from the beach. Small casks are the most convenient in foul weather; but, otherwise, you raft the casks off from the ship to the beach.

"Quail Island, though centrically situated, is too near the main land to assist any one in finding the anchorage. Do not approach it, on any point, nearer than half a mile, as the vicinity is rocky, and some rocks do not appear above the surface. Saluted the governor with thirteen guns, which were returned with an equal number, and every officer was treated with respect."

† Published by Mr. Egerton, London, 4to, 1803.

"Since the commencement of the last war, two forts have been erected, one of fourteen, the other of eleven, guns. They are both enclosed with a wall, kept in good order, and whithwashed, which make a pleasing appearance. There are, also, several redoubts, with guns mounted in them, but in a ruinous state. The inhabitants are chiefly black, a few officers about the governor excepted. The troops appeared to be natives of the island, black, and poorly clothed. From the height that the forts and town stand on, a tolerable defence toward the sea might be made; but if an enemy were landed, the island would instantly fall, particularly as it has few internal resources; and even water is brought from a well in the valley at the back of the town, the only place where they get water in the dry season, which could be cut off. At the time we were here, the ground was parched up, exhibiting a barren waste, scattered with pumice-stones and other volcanic matter."

It seldom rains here, but a dry haze is very prevalent. In December and January the wind is frequently far to the eastward, veering, at times, to the northward in the same season. In settled weather there are often regular land and sea breezes in the bay; the sea-breeze setting in near noon, with a great surf on the shore, and ending at 4 or 5 o'clock in the afternoon. The N.E. wind sets in toward evening, and continues during the night. As there is generally some surf on the beach, boats should lie at their grapnels; and the casks of water be hoisted into them, after being filled at the well, and rolled down and floated through the surf.

A spirited individual has, however, at considerable expense conducted the water to the beach at this place, so that it can be filled with great facility, and be obtained in a good state for ships' use. Formerly it was, as above mentioned, a service of much difficulty and toil to water a vessel at Port Praya, as the casks had to be rolled up to the well, not the cleanest in the world, and the water to be baled up in buckets. The *Vindictive*, of fifty guns, in April, 1842, obtained sixty tons, and she was only in the anchorage twenty-four hours. Merchant vessels are supplied, by rafting, by the boatmen, who charge 3d. for a large cask. The cost of the water is about 320 reis the hogshead.

For sailing into Port Praya Bay, you may borrow on the eastern point (*Ponta das Bicudas*) to 7 or 8 fathoms of water, and thence proceed, north-westward, to the anchorage. It is to be noticed that the ground is foul in different parts, particularly on the western side.

The best anchorage is, to bring the flagstaff on the fort N.W. by N. [*N.W.*] about three-quarters of a mile, the body of Quail's Island West, and the point of the bay opposite Quail's Island E. by S., in 7 and 8 fathoms. Many commanders prefer anchoring nearer the N.E. side of the bay than the Isle of Quails, for the sake of more easily getting under sail, without running the risk of being carried by the currents upon the points of rocks to leeward, before the vessel has gained fresh way enough to steer clear of them; and it has been observed, that vessels may anchor anywhere in the bay, from 9 to 11 fathoms, good bottom, but nearer to the eastern shore than to the Isle of Quails, as the wind, except in the months of August, September, and October, generally blows from the N.E.

H.M. ship *Tartar*, Sir George Collier, anchored with the best bower in 11 fathoms nearly in a line with, or a little within, the two other points, ground of sand and bits of coral. Quail Island then bore N.W., the flagstaff of the fort N.N.W., and East point of the bay E. ½ S. A salute of thirteen guns was returned. Stock of all kinds was in great plenty.

"The Bay of Praya being under the South end of St. Iago, should you be to the leeward of it, you will find it difficult in beating to windward against so strong a current as there is here. In the months of July, August, and September, the rains are frequent, and the southerly winds which then prevail cause a great sea in the bay, with a great surf on shore. The inhabitants, in these months, are subject to dangerous fevers."

For the position, see the Table, page 55. For the tides, page 175.

The sandy cove, on the East side of the bay, is an excellent place to haul the seine in; as is also the head of the bay. The principal fish are the mullet, gray and red, rock-fish, snappers, cavalla, and a variety of small fish.

The governor-general of the Cape Verde Islands resided formerly at St. Iago, an episcopal city, and the capital of the island; but foreign ships having totally abandoned

the road of St. Iago, which is very bad, and of difficult access, to come to that of Praya, the governor now resides at this bay during the dry season.

To those bound from Praya Bay to Bonavista, Mr. Keilor recommends, that they should endeavour to sail in the evening, as the current will be favourable: he adds, do not stand too far over toward the African shore, nor work between Mayo and St. Iago, and you will find the ship get to the eastward very fast.

A recent visitor, in a communication to the *Nautical Magazine*, September, 1844, p. 541, thus writes of this place:—

"Port Praya is a spacious bay, well sheltered from the N.E. wind, which prevails nine months in the year; during the months of July, August, and September, the wind is frequently from the S.W., seldom blowing home, but always accompanied with cloudy weather and a heavy swell. Even at this season, I consider a vessel perfectly safe, particularly if small: she can be moored, under the inner end of Quail Island, in 3 to 3½ fathoms, in smooth water. When at anchor, it is necessary to wait for the visit-boat, which generally boards in about *an hour;* everything proceeds in the same poco-a-poco fashion here, and there is nothing but indolence to encounter. The port charges amount to about twelve Spanish dollars: a custom-house officer remains on board until the vessel sails, for whom they charge a quarter-dollar per day in addition; a trifling duty is also imposed on all stock taken on board. Water of an excellent quality can be procured at one dollar per puncheon, the casks being taken from the vessel empty, and brought back full, from a cistern on the beach, to which it has been brought in pipes. If a vessel does not remain at anchor twenty-four hours, there are no port charges; this fact, however, is kept carefully concealed, and every obstacle, that laziness and inactivity can produce, is thrown in the way of the vessel's escaping payment.

"Stock and fruit are cheap and plentiful at Port Praya. Good bullocks, weighing about 350 lb., cost twelve dollars; fowls, four dollars per dozen; turkeys, one dollar each; sheep, four dollars each; oranges, half a dollar per hundred; plantains and bananas cheap. These are the cash prices of the articles; but they may be obtained, on barter, for old clothes.

"The greater number of inhabitants are negroes, many being free; only a few officials, and five or six military officers, having any pretensions to be called white. The soldiers are negroes, at present under the command of a Pole, in the Portuguese service; they are by no means badly equipped or disciplined. The whole inhabitants are, however, in a half-civilized state, caused, I suppose, by their confined intercourse with strangers."

REMARKS ON ST. IAGO, ETC., BY CAPTAIN J. W. MONTEATH, 1824.

November 20, 1824, at 4^h 20′ p. m., Mount Ochel, on the N.E. end of Bonavista, was indistinctly seen through the haze (which generally prevails among these islands) bearing N. 80° W.; the latitude (estimated by observation at noon), 16° 10′; the longitude, by chronometers, at the same time being 22° 8′ 30″ W. From this position we shaped our course so as to pass well to the eastward of the Island Mayo, in case there should be any westerly current.

The wind during the night continued fresh, and steady from the N.E., the vessel making a S.S.W. ¾ W. course (by compass), at the average rate of 6 miles an hour. At four a.m., estimating ourselves (by the distance run) to be in the latitude of the South point of Mayo, we hauled by the wind on the larboard tack, under easy sail; at daybreak, bore up, under all sail, on a W. ½ N. course. Notwithstanding our vicinity to the island, the haze prevented our seeing it until within 5 leagues of it; the high hill on the centre then bearing W.N.W., and the North point N.W. by compass. At nine a.m. the longitude by chronometers was observed as 22° 57′ 30″; the course until eleven was W. by S. ¾ S., *true*, distance 14 miles: at the same time, English Road bore N. by W. ¾ W., *true*, distant 4 miles.

From the coloured appearance of the water (a dirty green) this morning, it is my opinion, that an extensive bank lies at least 20 miles to the eastward of Mayo, and had I observed it previous to making sail, I would have sounded it, in order to ascertain the depth of water on it; but, being anxious to get into Port Praya as early as possible, I did not heave-to for that purpose.

In running from Mayo toward St. Jago, I would advise vessels to steer directly for the most southerly point of the latter island: this will carry you about 4 miles clear of the S.E. point, which is low and rocky: between it and St. Francis's Bay are a number of black patches of rocks, a considerable way inland, and which, at that distance, have the appearance of low bushy trees.

The *Bay of St. Francis* may easily be distinguished from that of *Port Praya*, from the West point of the former being high, while that of the latter, *Cape Tubaron*, is very low and rocky; it has also a fort with a flagstaff, which is distinctly seen before you open the Bay of Praya; this, of itself, is a sufficient mark for the harbour.

The beach in St. Francis's Bay is sandy, and has a great number of palm trees growing close to it; there are only two houses in the bay,—the one on the western, and the other on the eastern, side. The flat, as mentioned by Captain Grant, is also a very good mark for this bay.

November 21, at three p.m., we rounded the East point of, and anchored in, *Praya Bay*, in 5 fathoms of water, black mud and sand, the eastern point of the bay bearing E.S.E.; fort at the town N.N.W., in a line with a high peaked mountain, and Point Tubaron in a line with the South end of Quail Island, S.W. by S. It is necessary to mention, that, in anchoring, you should endeavour to shut in (or nearly so) Point Tubaron with the South end of Quail Island, as outside of this line the ground is very rocky, and you may have difficulty in purchasing your anchor.

After anchoring, we pulled toward the landing-place on the N.E. side of the bay, but were informed by a sentinel that we could not land until the visit was paid, which took place in about half an hour, with the usual Portuguese formalities: we were then informed that we were at liberty to land. You are not allowed to embark after sunset without a pass.

The Island of St. Iago is high, mountainous, and rugged; it, however, contains many extensive valleys, affording good pasture for cattle, with which it formerly abounded; and, were it in the hands of any industrious nation, would be capable of very considerable improvement. Although about Praya the water (except by wells) is scarce, yet in the other parts of the island, as I was informed, it is well watered, and, by irrigation, might produce sugar, maize, and vegetables, in abundance; but, from the rapaciousness of the government, the people have no encouragement to improve their condition, which, at present, is miserably poor, as they are fleeced of everything which can, by any pretext, be laid hold of. Cotton and indigo thrive well, the whole of the valleys and heights about the town being covered with these plants; but the people do not take any pains to cultivate them.

The town of Praya stands on a hill at the bottom of the bay, and consists of three streets, extending in an East and West direction. The *Plaza*, or square, is in the N.W. quarter of the town, and contains the custom-house, barracks, jail, and other public buildings. All the inhabitants, fit for service, are armed with pikes, and are drilled regularly every morning in the square by the officers of the garrison. The fort, which faces the bay, mounts forty pieces of cannon, principally nine and twelve pounders, and which are in tolerably good order. The magazine and church stand on the western side of the fort. There are two other forts on the heights on the eastern side of the bay, which command the road, and would prove very servicable in case of an attack by sea.

The landing-place for goods is on the N.W. part of the bay, from which there is a road to the town; this road is, however, very steep, and all the goods are carried up the hill by negroes, which incurs a considerable expense to the owners. The well is situated in a valley at the back of the town, and is nearly half a mile from the landing-place; it was formerly kept very dirty, but the present governor has built a shed over it: there is, also, a crane, with eight buckets attached, and a guard placed to prevent any improper use of it. You may land the casks and fill them, with your own people; but I should prefer getting this done by the natives, as the heat is very oppressive, and the sailors are so liable to get sick, owing to the heat, and the facility with which they are supplied with the spirits of the country, which are wretchedly bad. The cost of a puncheon from the boat, filling at the well, and rolling back to the beach, is three-quarters of a dollar; small casks in proportion. I was informed, that the governor intended to bring the water in pipes to the beach, and charge the above price; if so, it will greatly facilitate a vessel's watering, and save the casks very much.

In January, 1830, it was officially announced, that the health-visit (the charge for which was formerly six dollars) was, by a royal decree, entirely and for ever abolished; and that, in lieu thereof, it is provided, that if any shipmaster desire a certificate, that his vessel has been admitted to entry, he shall have the same, on payment of one dollar. The port-charges at Villa de Praya were, at the same time, reduced to less than ten dollars.

Fruit was, formerly, very abundant and cheap; as were cattle, goats, and pigs.* There is an export duty of fifteen per cent. on cattle, pigs, goats, and corn; turkeys and fowls at the town are, in general, scarce, but can be procured, from the interior of the island, in two or three days; these pay no export duty. The greatest revenue arising from these islands to the crown of Portugal is obtained from the orchilla weed, and which is monopolized by the government.

The governor-general resides here during the dry season, but, on the approach of the rainy months, he removes to Bonavista. He is making considerable improvements at Villa de Praya, but is much hampered by want of money, the court of Lisbon sending out no returns in lieu of those sent from the islands.

The Americans of the United States have a consul here, and have considerable trade among the islands, which they supply with coarse India goods, tobacco, fish, lumber, butter, shoes, tea, and a variety of other articles, which they barter for hides, goat-skins, old copper, and camwood, which last is procured from Africa.

Through the polite attention of the British consul-general, who procured for us everything we required, we were next day ready for sea; and to that gentleman and his lady we were much indebted, during our stay, for the attention and hospitality we received from them. At sunset we got under way, without difficulty, and proceeded on our voyage.

The latitude of the anchorage, by circle and sextant, was observed as 14° 53′ 57″, and the longitude, by mean of chronometers, as 23° 31′ 15″.—(*See the note on page* 56.)

H.M.S. *Beagle* visited Port Praya, in *January*, 1832, and *Captain FitzRoy's* remarks on this place, as *then* conditioned, are as follow:—

"The wind being always from the North or East during this season of the year (December to June), a ship can moor as close to the weather shore as may be convenient; but during July, August, September, and October, no vessel should deem the bay secure, or anchor near the shore, because southerly gales sometimes blow with great strength, and the *rollers*, or heavy sea sent in by them, are dangerous to ships which have bad ground tackle, or are lying near the land. As I have myself experienced the force of these gales, in the vicinity of the Cape Verde Islands, and witnessed the sea raised by them, I can confidently warn those who are inclined to be incredulous about a gale of wind being found in 15° of North latitude, beyond the limits of the hurricane regions.

"Strong gusts come over the land into the bay during the fine season, when the breeze is fresh; therefore, a ship entering, with intent to anchor, ought to have a reef in her topsails, and be ready to clew up the top-gallant sails at a moment's warning.

"The vicinity of Port Praya offers little that is agreeable to the eye of an ordinary

* But, in a dreadful mortality which prevailed among the cattle, in the month of March, 1828, the greater part is said to have perished.—Ed.

The *Salem Register* (American paper), in October, 1832, gave the following melancholy details of a famine at these islands:—"By the arrival at this port of the *Fredonia*, Captain Rider, in thirty days from Port Praya, we learn, that a universal famine extends through the whole group of these once truly verdant islands. Three years have now elapsed since they have been visited with rains in any considerable quantities. The land in the meantime has become parched and unfit for cultivation, and has yielded little, or nothing, to repay the toil of the cultivator. The season for the crops of the present year has nearly gone by, and the seed remained in the earth without signs of coming to maturity, unless it should be speedily visited by copious rains. The trees, and all kinds of vegetation, are withering and passing away. Most of the animals in the islands have died from starvation, and those that remain are of no service to the inhabitants, they having strength hardly sufficient to sustain their famished bodies. It would be difficult to present to the reader an adequate idea of the horrid condition in which the inhabitants were placed when Captain Rider sailed. At every port at which he stopped, the utmost misery existed among all classes." This is a serious specimen of the vicissitudes to which the islands are subjected.

visitor. A desolate and hilly country, sun-burnt and stony, with but few trees, even in the valleys, and those only the withering spectre-like trunks of old palms, surround the harbour. The distant and higher parts of the island, however, present a striking outline; and no person, who has visited the Port of Praya only, can form the slightest idea of the beauty of the interior country.

"Fruit was abundant: there were oranges, grapes, plantains, bananas, sour-sops, mammee apples, guavas, quinces, sapodillas, papaw apples, pines, citrons, medlars, figs, and, occasionally, apples.

"Notwithstanding its unfavourable exterior, its small and dirty town, and its black or brown population, I am inclined to think Port Praya of more consequence to shipping than is usually supposed. Water may be procured by rafting the casks, placing the pump in the well, and hiring a few of the natives to do the more laborious work of filling and rolling. The local authorities are attentive and obliging: it is, indeed, their interest to be so, because much of their trade, and even many of the necessaries of life, depend upon the visits of shipping. Fowls, turkeys, and pigs are very plentiful, but it is better to procure them by barter than with money. Clothes, new or old, are eagerly sought for, and their full value may be obtained in the produce of the island. The population is said to be about 30,000, a few of whom are Portuguese by birth, and many are descended from Portuguese parents, but the greater number are negroes.

"The exports were small quantities of sugar, cotton, and coffee. Hides of small bullocks, sheep and goat skins; horses, mules, and asses, of an inferior description, are sometimes sent to the West Indies. The orchilla weed, so much used in dyeing, is, however, the staple commodity, and, under proper management, might be made highly profitable. At the time of our visit, the yearly revenue, arising out of the government monopoly of this article, amounted to 50,000 dollars; and in some years it has been as much as 300,000. This weed grows like a kind of moss upon the cliffs, and is collected by men who climb up or are let down by ropes, like the samphire gatherers. The natural dye is blue, approaching to purple; but, by using metallic and other solutions, it may be turned to purple, crimson, or scarlet. A kind of castor-oil plant is found, from which a small quantity of oil is obtained, and a sort of soap. Yams are very scarce; but vegetables of various kinds have been abundant in their seasons.

"*From August to October* is the rainy and sickly season. In September, a S.W. gale is usually experienced; but from five to ten hours before its commencement, a dark bank of clouds is seen in the southern horizon, which is a sure forerunner of the gale. Should a vessel be at anchor in the port at such a time, she ought to weigh and put to sea until the storm has ceased, and the swell subsided. In the month of September preceding our visit, an American merchant brig and a Portuguese slaver were at anchor in Port Praya. A bank of clouds was seen during the day in the S.W., and the American went to sea; but the slaver remained at anchor. A storm arose at night, drove the slave-vessel ashore, and dashed her to pieces in less than half an hour, yet did the American no damage whatever, and the next day she anchored again in the port.

"In a valley near the town is a very remarkable tree of the baobob kind, supposed to be more than 1,000 years old; but I am not aware of the grounds upon which this assertion is made. Wild guinea-fowls are found in flocks, and there are wild cats in the unfrequented parts of the island; but, if induced to take a gun in pursuit of the guinea-fowls, I would advise a stranger not to overheat himself, or sleep on shore at night; for fatal fevers have been contracted by Europeans who were unguarded as to their health, while passing a few days in this hot climate, after being for some time accustomed to the cold weather of a high northern latitude.

"Except during the rainy season, the wind is always north-easterly, and then the sky is clear and the sun very powerful; but a dry haze hangs over the island in a peculiar manner, and a quantity of fine dust, quite an impalpable powder, frequently settles on every exposed surface, even on the sails and rigging of a vessel, when passing near the islands.

"*On the 8th of February*, our instruments were re-embarked, and after swinging the ship to ascertain the amount of local attraction, we weighed anchor and sailed. By the compass, fixed upon a stanchion in front of the poop, not 20' difference of bearing could be detected in any position of the vessel, the object observed being the highest point of a sharp peak, distant 11 miles.

"On the 13th, a very confused swell seemed to presage a change of weather. (Lat.

40° N., lon. 27° W.) Hitherto the wind had been steady from the N.E., and the sky clear; but on this day, large soft clouds, light, variable breezes, rain, and sometimes a short calm, showed us that we had passed the limits of the N.E. trade-wind.—14th. Similar weather, with a good deal of rain, but still breeze enough to keep us moving on our course.

"On the 15th, the wind was steady from E.S.E., and the sky free from threatening clouds. We had then entered the S.E. trade-wind, without having had two hours calm." —Vol. ii. pp. 51—56.

FUEGO, or FOGO.—This island, much higher than any other of the Cape Verde Islands, is only a continued mountain, rising into a peak of great height, which burns continually. The height of this peak is 1,626¼ fathoms above the level of the sea. This island has, nevertheless, some inhabitants, whom the eruptions of the volcano force sometimes to quit the island. The ground is clear within a mile of the shore, on the N.W., West, and South parts; but, on the S.E., East, and N.E. parts, it is rocky. At about 4 miles from the North end of Fogo lies a rock, with 12 or 14 feet of water on it, over which the sea breaks when it blows hard, but not else, and the bottom is clean all round it.*

The town is that of *Nostra Senhora da Luz*, or *Lux*, on the western side. The road-stead is open, and the anchoring ground off the town very close in, being only half a mile from the shore. In 25 fathoms, rocky bottom, the northern extremity bears N. 20° E. [*N.* 4° *W.*]; the southern extremity, S. 68° E.; the northern flagstaff, N. 85° E.; the southern, N. 21° E.

No other soundings are to be obtained near either Fogo or Brava, with a line of 130 fathoms, at three-quarters of a mile from shore.

The marks, says Mr. Keilor, when a brig was at anchor off the town, in 10 fathoms of water, were, the town bearing E. by N., a quarter of a mile; the mount, E.N.E.; the South end of Brava, S.E. by S. The bay is open, with foul ground, and a bad landing for boats. Corn, fruit, and cattle, may be purchased at Fogo, but water is scarce.

BRAVA.—Brava is very high, and might be seen at a great distance, were it not constantly covered by a dense atmosphere. Its climate is temperate and healthy. The winds here prevail at N.E. or East, most part of the year, excepting in July, August, and September. The channel between Fogo and Brava is 9 leagues in breadth. Five miles to the N.N.E. of Brava are the *Rombos*, or *Romes*, two small rocky isles, nearly connected by smaller rocks, forming a crescent. The westernmost isle is lofty, and has a peak on it. Between these islets and the North end of Brava is a clear passage. Brava has, heretofore, had plenty of corn, live stock, and fruit; but bad landing for boats, except in the harbour on the N.E.

Although Brava is very high, its mountains rising one above the other, like pyramids, yet, being so near the Isle of Fogo, it seems, in comparison, to be but low. It produces plenty of salt, and abounds most with saltpetre of any of the islands. According to Captain Roberts, it has several bays, or roads, where a ship may anchor, the best of which, called *Furna*, or the *Oven*, lies toward the N.E. end of the island; if you haul in near the rock, which is a very good key, having water enough by the side for a first-rate man-of-war, you will lie land-locked from all winds; nor does any wind blow in there, except from the S. by E. to the S.W., which heaves a sea into the bay, and makes it very well deserve the name of a harbour.

The natives of Brava are all blacks, and very few; you will find them the most harmless, hospitable, and generous of all the islanders.

ST. NICOLAS.—At this island vessels of different nations have occasionally touched for refreshments, which were sold at moderate prices. The land is high, and the coasts, therefore, subject to heavy squalls, &c.

There are two remarkable mountains, which may be seen from a distance of 15 leagues; one in the shape of a sugar-loaf, called the *Peak of Trade*, which is near the middle of the island; the other, *Monte Gordo*, near the West end.

From English Road, in Bonavista, to the East point of St. Nicolas, the *true* bearing is W.N.W., and the distance 22 leagues: the course must be regulated according to the

* Not inserted in the Admiralty Chart: its existence is, therefore, questionable.

set of the sea. The East end of the island may be known by its being a platform point, having a pyramidal rock, which appears like a sail, at a short distance.

On the South side, at 1½ leagues from this end of the island, is a bay, having a black sandy beach and a pond of fresh water, supplied from the mountains, and hence called, by the English, *Freshwater Bay.* To anchor in this bay, shut all the land to the eastward within the East point of the bay; you will then lie in 7 fathoms of water, within half a mile from the shore. There is good landing for the boats, with plenty of good water in fine weather, and at neap tides; for, as the tides rise here 5 or 6 feet on the new and full moon, the pond is then overflowed. At this time you are subject to heavy squalls; and, notwithstanding the wind blows off shore, the sea is very high close to the beach.

At about 4 leagues to the westward, from the middle of Freshwater Bay, lies *St. George's Bay*, where a ship can get refreshments; but there is no water. This bay is known by a sugar-loaf mount, and a flagstaff on the hill above the bay: there is tolerably good anchoring in 7 fathoms, close to the shore; but, without that depth, or in 9 or 10 fathoms, the ground is rocky. There is a shelf stretching S.E. by S. from the N.E. point of the bay, on which less water is found than within it; so that, should your anchor start, which will happen if you are not careful, the bank being very steep, and the squalls very sudden, it may hook this shelf and be lost. The marks to anchor are, the cove, or landing-place for boats, N.W., distant a quarter of a mile; Sugar-loaf Mount N.E. by E., and the flagstaff N.W. by N.

On the S.W. side of St. Nicolas is *Terrafal Bay*, where you may anchor in from 20 to 10 fathoms, with the coast to the southward bearing S. by E., and the Islands Raza and Branco in a line bearing N.W. by W. ¼ W. [*W.N.W. ½ W.*], and the landing-place E. ½ N. a quarter of a mile.

The custom-house is situate on the S.E. angle or corner of this bay. From this to the West point of St. Nicolas there is a bank of soundings, with from 40 to 20 and 35 fathoms at half a mile from shore. In the last depth is anchorage, in sandy ground, at a mile S. by W. from the West point, but sheltered only from the N.E.

There is, in Terrafal Bay, a high bluff rocky point, nearly a quarter of a mile short of the sea-side; in which place it is low, stony, gravelly, and in some places, shingly ground, the shore being a pebbly beach. On each side of this point is a very deep gully, out of which come violent flaws or gusts of wind; and, therefore, when anything of a hard gale blows, it is very difficult to turn up into this bay. To avoid these flaws, you must anchor right against the point, between the gullies, where you may ride very easy under its lee, in from 16 to 3 fathoms.

Within this bay the depths are 12, 13, and 14 fathoms, soft ground; and then they shoalen gradually to the shore, to the depths of 4 to 5 fathoms, where you have again sand to the pebbly beach.

By digging a well, almost anywhere on the low land, you may water here, unless the rainy season has failed; but there is always water in the valley, about half a mile from the sea, whence the natives will bring it down on asses for a trifle. From this road you may see, in clear weather, all the leeward islands; but, if it be in the least hazy, the Isle Raza is not discernible.

RAZA, BRANCO, AND ST. LUCIA.—These islands lie between those of St. Nicolas and St. Vincent, as shown on the charts. Rugged and mountainous, they partake of the general character of the other islands. RAZA lies *true* West 8 miles from the West point of St. Nicolas, and appears in the old charts under the name of *Chaon*, or *Dog's Isle.* It is nearly 2 miles long, from East to West, and 1½ broad. The landing-place is under the N.W. point, facing the West. This island is low and uninhabited. The edge of its coast is steep and rocky, and landing is difficult when there is any wind. Between it and Branco, at about one-third from Raza, is a coral reef, extending S.S.W. and N.N.E., and having on its shallow part 6 fathoms of water, but deepening gradually on the West to 15, and on the East to 18 and 20 fathoms. The sea continually breaks over the reef, owing to a strong tide, or current, setting through between the isles.

BRANCO, the Redonda of the old charts, is a league to the N.W. of Raza, and much higher. In the passage between are soundings of 6 to 18 in the middle, and decreasing near Branco to 7 fathoms. The latter is a narrow island, 2½ miles long from S.E. to N.W. A spit of sand stretches from its S.E. end, on which the rollers or break are violent, and its shore is altogether rocky.

Praya Branco, on the N.W. side of the island, has a small village of about thirty stone-built houses, thatched with reeds. The scenery here, being on the side of a stupendous mountain, is picturesque and magnificent; a small stream of water supplies the village; bananas and papayas are planted on the borders of the brook; cassada and vines on the banks of the valley: the latter grounds are so laid, that they can be irrigated; for which purpose the soil is supported on its different levels by stone walls, about 3 feet high. Sugar canes are cultivated in small quantities. The bread is made from maize, or Indian corn, and from farina, or flour of cassada. The natives are, in general, poor, but very courteous.

Monte Gordo, or the Broad Mountain, is in the central part of the island, toward the West. Its summit is 4,200 feet above the level of the sea. The mountain is composed entirely of volcanic matter, very fragile and porous, and does not form a peak like many of the smaller ones on the island. It is well clothed with vegetation, even to the summit. The *Euphorbium balsamifera* flourishes to about 3,700 feet above the level of the sea. The prospect hence is very extensive, calm, and beautiful.—*Mr. Forbes; Captain Owen*, vol. i., p. 27.

ST. LUCIA lies at the distance of 3½ miles to the northward of Branco, and the Bank of Soundings extends to this island. The bank here forms a regular flat of 10 to 13 fathoms. The South coast trends nearly East and West 4 miles, and in the middle of it is a good landing-place. A steep bank, half a mile broad, stretches from it, having on its edge 2 to 4 fathoms. In the bay formed by the S.W. coast are the ruins of a village, at three-quarters of a mile from the South point. To the westward of this is a little islet, named *Leon*. The N.W. part of St. Lucia rises into high mountains.

Captain Bartholomew describes St. Lucia as of moderate height, with a bay on the S.W., where small vessels may anchor, being sheltered from all points but South and S.E. The beach is sandy; the anchorage, small pebbles and sand. In the middle of the bay is an islet, named *Leon*, with the ruins of a village on it, and frequented by fishermen only. There are many turtle here, and much orchilla is gathered, with some cotton, in a wild state.

These islets are occasionally visited by parties from the other islands, for the purpose of hunting wild bullocks and goats.

ST. VINCENT'S.—The Island of St. Vincent is separated by a channel, 4 miles broad, from that of St. Lucia, and by one of 7 miles from that of St. Antonio. This island is 11 miles long, from East to West, and about 6 broad. It has two chains of mountains, facing the N.E. and S.W., which form a central valley that terminates in the bay called *Porto Grande*, upon the N.W. side of the island. The N.E. coast forms two bays, separated by a low peninsula, of 2 miles on either side, and this coast has been described as altogether dangerous.

The general aspect of it is mountainous, with sharp peaks; the coast is rocky, and rises abruptly, but the tide, ebbing, leaves a sandy beach. No doubt can be entertained that the general character of the island is volcanic; the interior is formed by ranges of hills of different heights. The surface of the country is undulating, and, in the interior and loftier parts, has a tendency to table-lands.

With regard to the geological formation of the island, consisting of feldspathic basalt, the soil is rich, in the valleys sandy, generally, as well in the plains as on the sides of the valleys, which, on the South side are fertile, particularly in the rainy season, where the ground is wooded, and in some places cultivated. At the depth of 7 or 9 feet below the surface of the valleys the soil becomes loamy, and abundance of water may be obtained, which may render the island capable of cultivation hereafter, with sugar, indigo, cotton, bananas, oranges, sweet potatoes, &c., Springs of water might easily be found by digging, that would yield a supply, not only sufficient for the inhabitants (about 560), but also for the different ships that might arrive.

With regard to the physical divisions of the island, it is divided by a valley running from West to East; in the southern division, one range of mountains proceeds from West to East; another from North to South, but both connected by a hill. The northern part of the island consists of mountain chains, lying N.E. and S.W., and N.W. and S.E.

I observed cultivated ground on a table-land, at the height of 2,400 feet; it produced beans and pumpkins, the former introduced from the West Indies. The only tree growing at this height is the euphorbia, but at the loftiest part there is vegetation.

The water runs from the elevated parts to the sea coast, and loses itself in the sand, but the quantity of it is not capable to form, in the dry season, a river; the principal valley is divided by a hill, which connected the northern and southern division. The water-course, running West, takes its rise 520 feet above the level of the sea: the bed is gravel, covered with mud, united by chalk. The coast forms a great number of little bays, in general capable of containing vessels; the chief port is named Porto Grande, situated on the West side of the island, and is a good anchorage for about 300 vessels: water and provisions cannot easily be procured: the former defect might be remedied. The wind blows generally from the N.E.; in the rainy season the S.E. wind prevails, which commences in the month of July, and ends on the 15th of October. During the last years the rains have been regular in point of time, but sometimes not in quantity.

Those of the inhabitants belonging to the negro race have, from their intercourse with Europeans, lost much of their original character; they live, generally, to a great age; for, amongst a population of about 560, some have attained the age of more than 100 years. They are a very industrious race, as far as regards the means of obtaining subsistence. They are in general handsome, and obliging in manner. The inhabitants are subject to the Portuguese, whose language predominates; there is not the least trace of the native language of the island. The only articles of traffic exported from this island are skins, fruits, and fish. The chief articles of food are vegetables, beans, and Indian corn, grown in the island; bananas are brought from St. Antonio; fish caught on the shores. Tobacco and clothes appeared to be most acceptable.*

Porto Grande is the largest and best bay in the Cape Verde Islands: it is capable of holding 300 sail of large ships, well sheltered under the high lands, and has a fine appearance. *Lieutenants* (since *Captains*) *Vidal* and *Mudge*, who surveyed this place in 1820, say of it, that it now forms a good and safe anchorage, where you may strip and refit your ship, as it is sheltered both from wind and sea. The wind generally blows from the N.E. over a part of the land, and seaward it is protected by the Island of St. Antonio.

Wood is plentiful, and sufficient water may be obtained from the well, on the eastern shore, for daily consumption. After a refit here, a complete supply of the latter may be found in the Bay of Terrafal, St. Antonio, which is 6 leagues to the westward, and reckoned the best watering-place among the Cape Verde Islands. Cattle may be had at Porto Grande, but they are not very good. The church and custom-house are situate in the bottom of the bay on the East, and a signal-post may be seen, erected upon a hill, at a short distance from the anchorage, which gives notice of whatever may be passing or approaching the island.†

Porto Grande is well adapted for refitting in, as well as acclimatizing the crews of vessels going to the African station. There is no endemic disease there, as at St. Iago; the climate resembles that of Ascension, without being so hot; and though there is scarcely any vegetation on the island during the greater part of the year, yet a sufficient quantity of live stock, vegetables, &c., for several vessels, can be always obtained there, and at the neighbouring island, San Antonio. It is deficient of water, as before stated, except for daily consumption.

* Description by Mr. C. G. Roscher, Naturalist to the Niger Expedition, July, 1841. *Naut. Mag.*, 1841, p. 734.

† March 30, 1822.—"On the *Leven's* arrival in Porto Grande, we sent on shore to a few houses called a town, at the bottom of the bay, to inform the governor who we were, and what were our wishes. We could find only one miserable Portuguese, the rest being all negroes; but most of them appeared to be free. The whole population did not exceed 100, without any plantations near their houses, as the soil is so very dry and sterile; but, on the sides of the mountains, in parts where there is water, they are said to have some good gardens. Indigo grows everywhere wild; and with it they dye their coarse cloths which they manufacture from cotton, and which, if ever planted by them, appears to be left entirely to nature's cultivation and care.

"We pitched a tent upon the beach; cleaned a well in a ravine, which, during the rainy season, is a water-course; then landed the women and a party to wash. During our stay the sea breeze every day blew furiously over the hills to the N.E. of our anchorage; and although the whole bay is nearly land-locked, yet the surf is very high all round, except in one spot near the town. We therefore embarked only a ton and a half of bad water, and caught a few fish."—*Captain W. F. Owen*, vol. i. p. 28.

The variation in June, 1841, was 17° 17′ W.; dip, 49° 10′. In 1820 the variation was 17° 46′.

Without the entrance of the bay, at nearly three-quarters of a mile from its N.W. point, is a remarkable steep islet, called *Bird Isle*, which, at a distance, appears round like a sugar-loaf. *Mr. Finlaison* says, "You may run in on either side of it, and will find regular soundings thence to the shore; depths from 30 to 10, 8, 6, 4, and 2 fathoms, to the beach. The ground is good in most parts of the bay, and you may anchor anywhere in 7 or 6 fathoms of water, sandy bottom, with coral branches. The water is very clear, so that you may pick out a clear spot for the anchor.

"Ships should moor with a kedge, as a very strong current commonly sets to the N.E. between Bird Island and the shore: and, as the N.E. wind is variable, at night it is impossible to keep a clear anchor, without this precaution; for the wind, at times, comes in strong gusts from off the land." *

Mr. Finlaison adds, "In running between St. Antonio and St Vincent we sounded in 42 fathoms, bits of coral mixed with sand and small stones. Within half a mile of Bird Island we had 42 fathoms.

"Having proceeded about 8 miles to the southward of St. Vincent's, 40 fathoms of water were found; and, on approaching *Still Bay*, at the S.W. side of the island, found regular soundings, ooze and sand, to 20 fathoms, nearly in the centre of that bay. We anchored in this depth, with the West point of the bay W. by N., and its East point E.S.E.: the distance between the two points is 2½ miles; regular soundings from the ship to the shore, and very good landing on the beach. The ground is perfectly clear of rocks, but the bay is open to the S.W. wind. Water is also to be got by digging for."

Captain Bartholomew describes the bay on the S.W. side as the *Bay of S. Pedro*, having a fine sandy beach, and he says that vessels may anchor in 10 fathoms, near the middle of the bay, or rather more to the westward. The anchorage is good in the dry season, and the inhabitants say there is plenty of wood and water. The American whalers frequent this place.

On the eastern side of the island is another anchorage, the *Praya da Gatta*, with a sandy beach, near which vessels may anchor in 6 fathoms; the bottom is clear, but a sea sets directly in when the wind is either N.E. or S.E., the Island of Sta. Lucia sheltering between these points. This bay and coast are without wood, water, and inhabitants.

ST. ANTONIO.—This island, as already shown, lies at the distance of 8 miles to the N.W. of St. Vincent, and it appears, altogether, like an assemblage of high mountains, particularly to the West. It is 22 miles in length, from East to West, and about 11 in breadth, and its highest peak is estimated at 9,700 feet above the level of the sea.

Of the two highest mountains in the West, the *Sugar Loaf* is the most elevated, and both are commonly covered with clouds. According to the late survey, the Sugar Loaf stands in 17° 4′ N., and 25° 20½′ W. The island is very woody, but has plenty of goats, fruits, and salt; it produces wine, cotton, indigo, &c. There is a village, *Santa Cruz*, on its S.E. side, but the ground is not fit for anchorage.

Terrafal Bay, which is only half a league to the northward of the S.W. end of the island, has been already noticed (p. 464) as the best watering-place in the Cape Verde Islands, and other refreshments may here be purchased. The edge of the bank, with 40 fathoms, is about one-third of a mile from shore. At a cable's length within are 50 fathoms, and it then shoalens inward to 20, 8, and 4 fathoms: the latter near the beach. Latitude of the landing and watering-place, 16° 57′, lon. 25° 24′ 48″. Variation, in 1820, 16° W.

"This watering-place of Terrafal Bay is one of the most convenient for the purpose amongst the Cape Verde Islands. The bay is spacious and has a black sandy bottom. Vessels anchor in 20 fathoms, at three-quarters of a cable's length from the shore, sheltered from the N.E. and South winds and sea: and when the wind comes to the

* In working between St. Antonio and St. Vincent, to Porto Grande, you may stand to a mile off St. Antonio, and as near as you please to St. Vincent, as the current generally sets strongly through to the N.E.—*R. Keilor.*

Mr. Finlaison says that ships bound through this channel should keep over toward the latter, as no danger whatever is to be apprehended on that side.

westward of South or North there is always, from the extreme high land, a calm in the bay, the wind never blowing home, but only occasioning a swell to set in.

"From the high mountains over the bay a small stream descends, which is never dry; on the first level spot a large pond has been formed as a reservoir to receive the stream, with a sluice to conduct it to the sands between the flat and the beach, which is a gradual descent; the flat may be about 60 or 70 feet above the level of the sea, and is generally moist and cool. In the vicinity of the pool is a fine plantation of bananas, papayas, &c., and in the lower sandy grounds a cotton plantation, with some trees of the *asclepias procera*. Just above the beach is a well; and when the water is let off from the pool, all the soil between it and the well must be saturated before any can arrive at the latter. The reservoir, it appears, was formed with a view to water the plantation only, but the crews of the small trading vessels, which take off the orchilla moss, dug the well below, rather than have the trouble of going to the pool. Three huts are used as orchilla stores for *Mr. Martinez*, who farms that weed.

"The negroes, at first, mistook our vessels for privateers, and would not, therefore, assist us in obtaining water. We were, consequently, obliged to employ our own people to keep it turned into the pool, and to open the sluice to obtain our supplies, which were completed in the course of a day, and the next morning we sailed for St. Iago.

"In going out of the bay the wind was light, and we warped out by sending a stream-anchor ahead, with two hawsers on end, where it was thrown overboard, the boat having had a depth of 35 fathoms the instant before; but it appeared to have fallen over a precipitous cliff, similar to that which lined the beach half a mile within it; for the anchor would have carried our cable, seemingly, as long as we would have veered it, and the boat could get no soundings with 60 fathoms; the consequence was, that the hawser was cut through at 30 or 40 fathoms from the anchor, and lost.

"We inferred from this, that the superstructure of this volcanic island was quite similar to that below the surface of the water: in short, that it was but the summit of an immense mountain, whose base may be as far below the surface as if it were an iceberg. As the highest mountain of St. Antonio is 8,000 feet high, and as the mean height of the island may be taken at 1,500, the base may be 3 or 4 miles deep. But as these speculations constituted no part of the object of our voyage, we made the best of our way to Porto Praya, and were caught between the islands with a calm and thunder squalls."—*Captain Owen*, vol. i., p. 30.

Of St. Antonio, Captain Monteath has said, "This island, the north-westernmost of the Cape Verdes, is high, and may easily be descried, in clear weather, at the distance of 18 leagues; by distances between the near limbs of the ☉ and ☽, 27th February, 1818, taken when the S.W. point bore N. by E. ¼ E., distant 25 miles, I made the longitude 25° 35′ 45″ W.; and, by chronometer, 25° 30′; the mean of which places the S.W. end of the island in 25° 25′ W. From the atmosphere being hazy in the horizon, I was prevented from ascertaining the true bearing of the S.W. point at the time of observation; but, from bearings taken previous, with the ship's run corrected, I am inclined to believe 25° 25′ W. to be nearly the true longitude, and not 25° 35′, as had been previously stated."

After passing St. Antonio, as above, Captain Monteath, between the parallels of 3 and 2 degrees North, found the current to set S.E. by E. in the twenty-four hours; but, between 4° and 14° S., the ship was set, by the Equatorial Current, 80 miles westerly in five days.

Captain Monteath adds, "*On approaching St. Antonio*, which is very high, and may be discerned in clear weather at a great distance, it appears black, rocky, and barren; consisting of immense rocks or mountains, heaped on each other, and rising far above the clouds, which, in general, cover a great portion of their summits. On the N.E. part of the island the mountains are divided by deep ravines and gullies, which have every appearance of deep water having passed down them: on rounding the N.E. point you will perceive to the S.W. large white patches from near the shore until about half-way up the mountains; at this distance they are not unlike ripe fields of corn; but, on nearing them, they are found to consist only of large white rocks, like pumice, and are entirely destitute of verdure; the mountains toward the centre of the island are composed of rocks of stratified basalt, in thick and perpendicular columns, to their very summits; it also rises more gently, for a considerable elevation, than either the N.E. or N.W. ends, but without verdure, excepting a few tufts of brushwood near the shore, and patches of

brown heath, with which this island is generally covered. From the N.E. point, until rounding the point of Sta. Cruz, the only habitations I could discern were two or three miserable looking huts built upon the shore, about a mile distant from each other.

"After rounding the point on which the town of Sta. Cruz is laid down on the charts, I kept a good look-out, expecting the fort or town to open to view: but was surprised at not seeing any appearance of either. However, after a minute search with the spy-glass, I did observe a few negro huts among a quantity of brushwood, in a small valley near the shore, and in which there appeared to be a little verdure; this was, in fact, the only place which I observed green in any part of the South side of this miserable island; and this, I suppose, must be the town of Sta. Cruz.

"The S.W. point is pretty well covered with brushwood, but I saw no signs of cultivation, nor inhabitants. The channel between this island and St. Vincent's is quite clear of danger; and within a short distance of the shore on each side (except off the point of Sta. Cruz, where the breakers run out about a mile) is bold-to, and I should apprehend that a vessel might work through this passage with little risk, either by day or night."

REMARKS MADE ON QUITTING CAPE VERDE ISLANDS, AND CROSSING THE LINE. BY CAPTAIN JAMES GRANT, R.N.

"On the 27th of April, 1800, we bade adieu to the Cape Verde Islands. On getting clear of the islands, we found a strong current setting to the South, which differed our latitude, by observation, 30 miles more to the South than our distance would give.

"On approaching the Line we found various currents, with heavy squalls, and sometimes rain.

"On the 17th of May we had an observation at noon, which gave us lat. 8° 11′ S., and lon. 27° 28′ W. The wind in general at S.E. and S.E. by S. I followed the directions of M. D'Aprés, and the observations of Captain Cook, keeping a good point free, as I thereby expected to get the sooner to the South, and clear of the S.E. trade-wind, having crossed the Equator in the lon. 20° 30′ W.; by this we did not see any part of the coast of Brazil. It may be proper to remark, that we found a current drifting us farther to the West than we had any reason to expect, and that the vessel's head was never farther to the West than S.W. by S., and sometimes S.W. by S. ½ S., which, with 13° West variation, ought to have given us, with a S.W. by S. course, by compass, a S.S.W. true course; instead of which, we have never been able to make better than a S.W. course. Of this I am the more certain, because we have not, these twenty-four hours, had occasion to steer on any point but one, S.W. by S., with a S.E. wind, and with every attention I could pay to the steerage. Such is the result of my observation. It is true that all voyage writers, who have navigated for the purpose of discovery, take notice of the different currents about the Equator, without being able to reduce them within any certain bounds or rate: and I much fear that this will always remain a source of error. These currents, as already observed, set to the westward; therefore I think our navigators in general, who cross the Line at about 20° or 21° West, might do it to more advantage at 12°, as by that means they will equally avoid the heavy weather experienced on the African shore.

"*On my return to Europe*, I found the winds as favourable for crossing the Line in nearly the lon. 12° as I did in 20°;* and, as the great point is to get into the variable winds, between the S.E. and N.E. Trade, to cross, I found them equally so; neither had we more rain. If a vessel, therefore, crosses at about 12°, she will not have so far to run to the West before she gets clear of the S.E. Trade; and, if bound to the Cape or India, where it may be acceptable to have a sight of the former, or of the land near it, she will greatly shorten the passage, as it is well known that many have fallen in with Cape St. Augustine or C. Roque, on the coast of Brazil, and, by so doing, were obliged to run from continent to continent, merely because they judged it useless or impracticable to cross the Line under 20° West. Independent of all this, there is another reason why, at certain seasons, the coast of Brazil ought to be avoided; that is, between the months of February and July, when the winds hang much to the South, being generally from S.S.W. to S. by E. and S.S.E. This is an old remark made by many, but not generally mentioned by navigators who have laid down directions for navigating

* This corroborates the remarks of M. la Perouse, p. 110, and of M. D'Aprés, pp. 269, 270.

these seas. The current on the coast of Brazil, from March to September, sets to the North; and from September to March back again to the South. No doubt, in doubling the Capes Roque and St. Augustine, the currents extend themselves more to the East, of which we had a sufficient demonstration, enabling me to account for the remarks already made.

"On the 18th we were in lat. 9° 50′ S, lon. 28° 28′ W., by lunar observations. Ever since the 12th instant we had no other than S.S.E. and South winds, blowing at all times very heavy and squally, with rain. This had impeded our course to the South very much, and carried us a long way to the West. Between the third and seventh degrees of South latitude we observed the diminution of the strength of the current to the West."

REMARKS ON SAILING WESTWARD OF THE CANARY AND CAPE VERDE ISLANDS, AND TOWARD THE LINE. BY CAP. FLINDERS, IN THE INVESTIGATOR, 1801.

"At daybreak, 9th August, 1801, the Island Palma was in sight, bearing S. 72° E., *true*, 10 or 12 leagues. Albacores and bonitas now began to make their appearance, and the officers and men were furnished with hooks and lines, and our harpoons and fizgigs were prepared. This day I ordered lime-juice and sugar to be mixed with the grog; and continued to be given daily to every person on board, until within a short time of our arrival at the Cape of Good Hope.

"We carried fair, and generally fresh, winds until the 15th, in the morning, when St. Antonio, the north-westernmost of the Cape Verde Islands, was in sight. At 8 o'clock the extremes bore N. 69° E., and S. 13° W., *true*, and the nearest part was distant 4 miles; in which situation no bottom could be found at 75 fathoms. A boat was observed near the shore, and our colours were hoisted, but no notice appeared to be taken of the ship.

"The N.W. side of St. Antonio is 4 or 5 leagues in length, and rises abruptly from the sea to hills which are high enough to be seen 15 or more leagues from a ship's deck. These barren hills are intersected by gullies, which bore marks of much water having passed down them. By the side of one of these gullies, which was near the place where we lost sight of the boat, there was a path leading up into the interior of the island. The S.W. and South points are low; they lie N. 14° W., and S. 14° E., *true*, and are 5 or 6 miles asunder. Between them the land hollows back, so as to form somewhat of a bay, which, if it affords good anchorage, as it is said to do, would shelter a ship from all winds between North and E.S.E. We did not observe any beach at the head of the bay; perhaps, from having passed at too great a distance.

"Some distant land opened from the South point of St. Antonio, at S. 72° E., *true*, which I took to be a part of the Island of St. Lucia.

"During the three days before making St. Antonio the wind varied from the regular N.E. Trade to E.N.E., and as far as S.E. by E.; and, at about the time of making the land, it dwindled to a calm. For three days afterwards it was light and variable, between North and S.E.; after which it sometimes blew from the N.W. and S.W., and sometimes from the eastward. These variable winds, with every kind of weather, but most frequently with rain, continued until the 23rd, in lat. 11° N., and lon. 23° W., when a steady breeze set in from the south-westward, and the weather became more settled and pleasant. The clouds were sufficiently dense to keep off the intense heat of the vertical sun, but did not often prevent us from obtaining daily observations for the latitude and longitude. At the same time with the S.W. wind came a swell from the southward, which made the ship plunge, and opened her leaks considerably.

"The south-western winds continued to blow without intermission, and drove us, much against my inclination, far to the eastward toward the coast of Africa. One or two attempts were made to go upon the western tack, but this could not be done with any advantage till the 2nd of September, when we were in lat. 3° 50′ N., and lon. 11° 15′ W. The wind had veered gradually round from S.W. to South as we approached the African coast, to the direction of which it kept at nearly a right angle. I had not fully adverted to the probability, that the winds blowing upon this coast would prevail to a greater extent at this season than at any other time of the year; otherwise, as I wished to avoid Africa, I should have passed some degrees to the westward of the Cape Verde

Islands, and probably have carried the N.E. Trade to the 12th, or perhaps to the 10th, degree of North latitude; and in 8°, or at farthest in 6°, the S.E. Trade might have been expected.

"Captain Cook, in his second voyage, experienced the same south-western winds, and was carried so far eastward, that he crossed the Equator in lon. 8° West. M. de la Perouse also experienced them, and both were here at the same season with ourselves; that is, in the months of August and September, when the African continent had received its greatest degree of heat.*

"Although I preferred to avoid Africa, it is by no means certain that a good passage to the Cape of Good Hope may not be made, especially at this season, by steering round the Bight of Benin with the S.W. and South winds. It is probable that, on approaching the meridian of Greenwich, the wind would be found to return to the S.W., and perhaps more westward, and enable a ship to reach the 10th degree of South latitude before meeting the S.E. Trade; in which case the circuit to be made, before attaining the western winds, beyond the southern tropic, would be much shortened."—(*Voyage*, vol. i., p. 28.)

8. BERMUDAS OR SOMERS' ISLANDS.†

The first discoverer of these islands was Juan Bermudez, a native of Galicia, in Spain, whose name they still retain, about the beginning of the 16th century.

In 1609, Sir George Somers, an Englishman, was drove thither by the violence of the wind, and some of his men returning to England so much commended these islands, then called Somers' Islands, from Sir George Somers, that in the year 1612, a society of English gentlemen and merchants, having obtained a grant from King James the First, sent over 60 men to begin a colony, under the direction of Richard More, who built eight forts, and several places.

The group of islands and the surrounding reef are of an oval form, the longest diameter lying N.E. by E. and S.W. by W. 25 miles, and the breadth 10 to 12 nautic miles. The islands themselves are on the S.E. side of the reef, and are shaped in the most irregular manner imaginable; they extend about 15 miles in length in the general direction of the reef given above. The breadth is very various, the greatest about 1½ miles. The chief island is Bermuda, containing the town of *Hamilton*, St. George's, with its town of the same name, Somerset Island, and Ireland Island, on which is the dockyard; these are the principal: besides these are St. David's, Longbird, Paget's, Smith's, Cooper's, Nonsuch, Castle, and many inferior islands and rocks.

The climate, being moist, is favourable to vegetation at all seasons, except during the droughts of summer, and the storms of winter.

Hurricanes and tempests are very frequent, as is to be expected from the proximity of the isles to the variable limit of the Trade and other prevailing winds. Few autumns pass without hurricanes of more or less violence.

The Bermuda Squalls are sudden and violent tempests, occurring particularly in the winter season.

As the day closes, the whole horizon becomes obscured by dark and heavy clouds, and the thunder and lightning, which precede the first squall, give notice of its approach. After the commencement, the wind, continually shifting, blows in tremendous gusts at intervals of every 20 or 30 minutes, a dead calm intervening; and the sea, rising in confused and breaking waves, renders the situation of a vessel, particularly a small one, very dangerous.

The conduct pursued by seamen, and which appears to be the most advisable under such circumstances, is to furl the ship's sails, and endeavour to get before the wind; by which means she may ultimately run clear of these local squalls into a steady breeze. It is an observation made by seamen who are familiar with the Bermudas Islands, that the various winds which blow meet there, and contend for superiority; and the inhabitants themselves remark, that the currents about their rocks are as variable as the winds, and as numerous as their islets.

* See the preceding remarks, by M. de la Perouse, p. 119.

† For some remarks on the currents about these isles, see p. 217.

The LIGHTHOUSE.—The most useful mark to mariners is the new IRON LIGHTHOUSE on Gibbs' Hill, on the South side of the island. This will very materially add to the security of vessels approaching by night. The official description and directions are as follow:—

A lighthouse has been erected on the southern part of Bermuda, in lat. 32° 15′ 4″ N., and lon. 64° 51′ 36″ West of Greenwich. A revolving light was exhibited on the 1st of May, 1846, and will be continued every night from sunset to sunrise.

It is elevated 362 feet above the level of the sea; and in clear weather may be seen from the deck of a frigate 7 or 8 leagues. It is higher than the adjoining land, and in day-time will appear like a sail. The light is intercepted between *N.* 43° 24′ *E.*, *true*, or N.E. ½ E. by compass, and *N.* 47° 34′ *E.*, or N.E. ¾ E. mag. nearly, by the hills at St. George's; and also, between *N.* 49° 7′ *E.*, *true*, N.E. by E. mag., and *N.* 57° 35′ *E.*, or N.E. by E. ¾ E. by compass, by the hills on the South side of the island. (These bearings differ 10° from those given in the public Notice.)

Bermuda is always approached with more safety from the southward; and in running for it at night, or in thick weather, care should be taken not to get to the northward of lat. 32° 8′ before seeing the light or the land.

In coming from the S.E. the light should not be brought to the southward of W. by S., or approached nearer than 6 or 7 miles during the night. Coming from the westward, it should not be approached nearer than 10 or 12 miles, until it bears to the northward of N.E. by E.

With the light between N.E. and West, the coast is free from danger, and may be safely approached within 3 miles.

Any vessel getting sight of the Light from the northward had better haul off immediately, as the reefs extend all round from the S.W. to the North and N.E. from 15 to 16 miles.

The light will show a bright flash, continuing for 6 or 8 seconds, and repeated once in every minute.

The situation of the lighthouse has been objected to by some, inasmuch as it is not visible at the chief entrance at St. George's. The light appears on an arc of a few degrees in the direction of Mills' Breaker; but, of course, a vessel will not depend upon making the light within the bearings given above.

There are four SIGNAL STATIONS on the islands. One on Fort George, at St. George's; central at Mount Langton, near the governor's house, near Hamilton; another on Gibbs' Hill, near the lighthouse; and another at the dockyard, on Ireland Island. By means of these, signals are transmitted from one part of the island to another, and vessels requiring pilots, &c., will be telegraphed to that effect.

THE REEF.—This singular tract, extending 25 miles in length, N.E. by E. and S.W. by W., with a breadth of 10 or 12 miles, forms at once an effectual barrier against the fury of the Atlantic storms, and, with the exception of the few narrow and intricate entrances, an impenetrable line of reefs and breakers, over which no vessel can pass.

It is composed of whitish limestones and sandstones, in many parts as if composed entirely of minutely pounded shells, and calcareous clay, resembling pipe-clay. Upon this, coralline structures grow in innumerable patches, and in every variety. It is to this circumstance that the great danger in navigating within the reef consists.

The water on the reef is remarkably clear, so that even small object are readily distinguishable at considerable depths. A dollar may be discerned at 16 or 18 feet; and the appearance of the bottom, in many parts, and in clear weather, is very beautiful, from the varied growth and structure of the coralline productions. To this circumstance of the transparency of the water the pilots owe their talent of conducting vessels through the mazes of the reef. Taking an elevated position in the ship, up the shrouds, in the top, or on the forecastle, and by the appearance of the bottom, they direct the course of the vessel. Brown or discoloured patches indicate coral and reefs. And it must be insisted on, that only the practised eye of the Bermudian pilots can be depended on for conducting a ship safely. The pilots are regulated by a legislative enactment passed during Colonel Reid's government, in 1843.

The outer border of the reef is shallower than the centre, many parts having less than a fathom over them, and the others varying from 3 to 4 fathoms. Within this external

and rocky barrier, which is about a mile in breadth, the coral and rocks raise their heads in countless numbers; the intervals having a depth of 5 to 10 fathoms. There are some large tracts clear from shoals, as that to the N. and W. of Murray Anchorage; these have a nearly uniform depth of 7, 8, or 9 fathoms.

Round the West, N.W., and North sides, it is a continued and very dangerous ledge of rocks, beginning at the *Long Bar*, the South part of which lies 6 miles W.S.W. from Gibbs' Hill: trending then N.E., it is called the *Chub Heads*, which, off Wreck Hill, lies 9 miles from the shore: the ledge hence rounds to E.N.E., and joins the North Rock, which is always above water, and lies N.N.W. 12 miles from Catherine Point. From the North Rock the reef rounds East and E.S.E., and ends in *Mills' Breaker*, which dries at low water, and lies at N.E. 6 miles from Catherine Point, and N.N.E. from St. David's Head. On the south-eastern side of the islands the reef bordering the group does not extend more than a quarter of a mile off shore; the outer edge is one continued line of breakers, many of which are dry at low water. Within the external and narrow border of rocks, on this face, the water increases considerably in depth nearly to the shore. At the S.W. corner of the reef, and on its outer edge, is a spot that always breaks, called the *South-west Breaker*. It lies 1¼ miles off shore, and is nearly South, true, from Wreck Hill. Round the outer edge of the ledge is a margin of soundings, of from 1 to 2 miles broad, having from 9 to 14 fathoms on it; there are, likewise, soundings for 2 miles from the shore round the N.E., East, and S.E. sides of the island; but, as the water here is deeper, it would be prudent for those who suspect themselves near the longitude of Bermudas in the night, or in thick weather, while between the latitudes of 32° and 32° 40′, to keep a lead constantly going, being assured that, at 14 fathoms, they will strike the ground in time to avoid danger. The lead might be incased with tallow, for the greater certainty of striking ground: this precaution would prevent many of the wrecks that constantly happen here.

The CHANNELS through the outer edge of the reef, commencing at St. George's at the eastern extremity, are, the *Narrows*, or channel into Murray Anchorage, sometimes called *Hurd's Channel*. This is regularly buoyed, and may be considered as the principal entrance to the interior of the reef.

South of this is the channel over the *Bar* to St. George's Harbour, hereafter described.

There is another channel running East and West to St. George's, called the *Boiler Channel*, passing North of, and close to, Jenkin's Boiler Shoal, with a depth of 12 to 18 feet.

Still farther South is an entrance sometimes used by small vessels running under St. David's Head, but has not more than 9 feet at low water. This leads in a N.W. direction.

Proceeding northward, the next channel is *Mills' Breaker Channel*, the entrance to which is half a mile North of the Mills' Breaker. Its direction inwards is S.W. towards the Narrows, and is only used by Bermudian vessels in and out.

Continuing in the same direction, the north-eastern face of the reef presents an impenetrable and continuous reef, often breaking, until we come to the *North Rock Channels*, having a southerly direction.

There are two channels by the North Rock: that on the East side of the Rock is called the N.E., and the western, the North-west Channel: they are known only to a few of the pilots, and from that cause but seldom used, although it is said that the north-eastern Channel is one of the best through the edge of the reef. The north-eastern Channel is narrow and intricate at it entrance: the general depth is 6, 7, and 8 fathoms, but in one spot but 5. At 3½ miles in the direct line from the entrance, toward Murray Anchorage, there lies a cluster of rocks, which render a circuit to the westward advisable. The mark for clearing the West end of these, the *Three Hill Shoals*, is Painter's Hill over a hill on the western side of the Ferry at St. George's Island, bearing S.S.E. There is also a channel through the shoals, which is more direct; the mark for which is Painter's Hill in the Hollow or Saddle of Two Hills (hence their name), at the West end of St. George's Island, bearing S. ¾ E. As soon as the shoals are cleared in either case, which will be when 3½ miles from the shore, you can bear round to the S.E. to Murray Anchorage, this part of the reef being clear.

The next is the *Blue Cut*, on the western side of the reef, but can be used only by small vessels. It is exceedingly narrow and intricate, and has only 8 feet water in places. Its direction is to the East of South.

The *Chub Cut* is the next channel southward: this is also narrow and dangerous. It leads southerly to Wreck Hill, or first southerly and then easterly to Ireland Island.

Hog Fish Cut lies at the south-western angle of the islands. For half a mile in a north-easterly direction it lies through numerous rocky shoals, and then turns to the N.W. It leads to Ireland Island and to Ellis Harbour.

The Hog Fish Cut, which has recently been examined with a view to its improvement, is the most convenient at the West end of the islands, particularly in the winter season, when the winds prevail at N.W., and the danger of being at sea and about the islands is the greatest.

The Hog Fish Cut, though not far from the land, is an entrance from the ocean, through the outer barrier of rocks. Before arriving at the Cut, there are the *Bream Shoals* to be carefully avoided. The course through what are called the Chops of the Cut is nearly at a right angle; the turn is very sudden and sharp, and the greatest nicety must be observed by the pilots in navigating it. The course in from the ocean to Hog Fish Cut is N.E., and from the Cut to the *Kitchen Shoals* N.W.; and the passage is so narrow that it does not afford sufficient space for vessels to tack in, and when a passage through them shall be attempted, it must be without a change of tack. These difficulties are felt more especially in the winter season, when the winds are generally unfavourable for passing the Kitchen Shoals. To remedy this evil, the committee appointed for the purpose (August, 1846) recommended the removal of the centre Kitchen Shoal, of coral (8 feet on it at high water), by the same means now employed at St. George's Harbour, when a passage sufficiently capacious would be opened, and vessels now often compelled to remain at sea, or make the circuit of the island in search of shelter, would find an easy and ready access to port.

The various channels here mentioned, having different directions, are available according to the wind; that which is fair for one, being the reverse for others: but they must not be attempted without a pilot, who will immediately come off from St. David's Head, upon a signal being given to that effect; and a vessel in the offing requiring a pilot, it is telegraphed from one part of the island to the other by the chain of signals established thereon. They will be best understood by referring to the Chart of these Islands.*

The south-eastern face of the reef forms nearly a continuous line of breakers, about 2 cables' length from the shore, and has no entrance or shelter till we come to *Castle Harbour*, the entrance to which, past the King's Castle, is in a N.W. direction. There is no other opening through the reef between this and the channel under St. David's Head, before described.

The SOUTH-WESTERN BANKS.—There is a rocky fishing bank lying from S.S.W. to S.W. from Gibbs' Hill (or S.W., part of Bermudas), from 3 to 5 leagues distant, and having 22 to 40 fathoms. These banks were surveyed in 1829 by the officers of H.M. sloop *Columbine*; according to whom the northern extremity of the *Inner Bank* lies in 32° 6' N., and 64° 58' W.; the S.W. in 32° N. and 65° W. The least water found was 29 fathoms, corally and rocky bottom. On the edges are 40 fathoms. To the S.W. of this bank is another, called the *Outer Bank*, the N.E. end of which was in lat. 31° 59½, lon. 65° 2¼; the S.W. end in 31° 57, and 65° 5. The least water found on this bank was from 38 to 47 fathoms, rocks and coral. From this Outer Bank the land is not visible.

THE ISLANDS.—IRELAND ISLAND is the north-westernmost of the group. The flagstaff, which is the highest point of the fortification, and stands above the breakwater, is in lat. 32° 19' 30", and lon. 64° 51' 40" W. It is one of the four telegraphic signal stations established on the islands. The site of the Royal Dockyard and Naval Establishment is on the North extremity of the island, from the rest of which it is separated by a deep dry ditch.

Ireland Island is about one mile in length, and perhaps a quarter broad, and is nearly all occupied by the buildings required for the officers, artisans, and for storehouses. The hospital is situated on the highest part of the island, and is very large and commodious. The officers' residences are built in the English style, and are very comfortable. The

* A New Chart of the Bermudas or Somers' Islands, with Plans of the Narrows and Murray Anchorage, and St. George's Harbour, &c., by A. G. Findlay, F.R.G.S., published by Mr. Laurie, accompanied by a description of the Islands.

most important work is the breakwater, similar to that at Plymouth. Several hundred convicts are employed on it. The dockyard is kept in fine order.*

Between Ireland and Somerset Islands there are several smaller ones, the chief of which is *Boaz's Island*, but there is no passage whatever between them.

SOMERSET ISLAND is the next in order. Its western point is Daniel's Head, off which is a small island.

Ellis or *Elies Harbour* lies between its southern extremity and Wreck Hill. This small harbour may be reached from the Hog Fish Cut, from Ireland Point, or by the Chub Cut. Between Somerset Island and the N.W. side of the reef the ground is all rocky, so that the channels to the harbours are very circuitous, and no directions can be given for them.

GREAT BERMUDA ISLAND.—This, the chief of the group, is about 12 or 13 miles in length. About the centre of it is the town of HAMILTON, standing on the North side of the harbour, an inlet of the island: it is a free port, and the seat of the legislature. North of the town, which consists principally of one street 1¼ miles long, parallel with the shore in an East and West direction, and about midway between the ferry at the West end of the island, and the dockyard, is one of the houses appropriated to the governor for the time being; it is scarcely seen from the water; but near it is a hill called *Mount Langton*, on which is a flagstaff, by means of which communication is kept up between St. George, Somerset, and the dockyard. A few miles beyond this is the residence of the admiral, *King's Hill* or *Clarence Lodge*. Between this and Ireland Island is *Grassy Bay*, the anchoring place of men-of-war.

From *Spanish Point* to Ireland Island a ledge of rocks divides the *Great Sound* from Grassy Bay. There are two passages through this: one called the *Stag Channel*, near Sober Island, the North entrance; and one nearer to Spanish Point: through these is the channel to Hamilton Harbour. There is also another line of reefs running between the North point of Somerset Island and the chain of islets South of Hamilton Harbour: this reef has also to be passed to enter the Great Sound, South of which is *Port Royal Bay*, which has a depth across it for boats only.

The eastern end of Bermuda Island is occupied by the *Little*, or, as it is more commonly called, *Harrington Sound*, a sheet of water only communicating with the sea by a narrow channel, called the Sound's Mouth, over which is a bridge at *Flatts Village*. Through this passage the tide ebbs and flows with great velocity, but does not pass in sufficient quantity to sensibly affect the level of the water within,

The southern shore of Bermuda is the boldest among the islands, and vessels may come in some places within half gun-shot of the shore.

East of Mount Langton is Brackish Point, near which is "*The Wells*," a government establishment for supplying water to the navy, should there be no water at the naval tanks on St. George's Island.†

(The following description of the coasts is principally by *Lieutenant John Evans*, (a) R.N.; commencing with the West.)

The westernmost projecting headland is *Wreck Hill*; it stands insulated on its base, is cone-shaped, and very dark coloured. When seen from the S.W. it appears flattened at its summit, but from the South as peaked: it is the land looked for, and first seen, when approaching the isles from the West.

GIBBS' HILL.—The next particular guide is *Gibbs' Hill*, which is the highest and most conspicuous eminence observable near the S.W. part of the coast; it is a smooth mount, entirely clear of trees, with the lighthouse previously described and a telegraphic post on its summit. To the westward, and contiguous to it, is a table-land, crowned with a grove of dark tall cedars.

Between Gibbs' Hill and Castle Island, to the E.N.E., there are several sandy mounts, having the appearance of white cliffs, and at moonlight may be mistaken for breakers. These are very remarkable, and are called the "*Sand Hills*." One of these is much more conspicuous than the others, being of greater extent, and without any verdure upon the summit. At 2 miles East of the great sand-hill is *Castle Harbour*, in the entrance to

* *Montgomery Martin's* Colonies, p. 112.

† Large fleets could not, as yet, find sufficient water at Bermuda.—*Governor Reid*, 1846.

which are several islets and rocks: on the largest of these is an old castle, which gives name to the harbour. These islets are remarkable for the colour of the cliffs and the dark verdure of the turf which covers them.

The coast here presents a very picturesque appearance of land and water; the telegraphic hill over St. George's is a pleasing object in the perspective. This may be termed the S.E. face of the islands, and is considered as in the best parallel to make them in from the eastward.

In the winter, with the wind from the N.E., there is a strong set of the water to the S.W. on the South side, and it is very tedious and unpleasant to turn to windward, the wind blowing in heavy squalls at intervals. I have, however, known South and S.W. winds to prevail during most part of the winter months.

CASTLE HARBOUR.—In Castle Harbour there is good anchorage; but it is not used by men-of-war. A frigate, many years ago, was wrecked in her endeavour to get out.

The southern channel to the harbour is narrow and intricate; the mark to lead across the outer edge of the reef is *Minor's Hill*, on the North side of St. George's Island, midway between Castle Island and Southampton Island. As soon as this is crossed, bear to the eastward, and steer close to the eastern side of Castle Island, which is steep-to, and then pass between the banks which border the channel for about one-third of a mile North of Castle Island; then bear round to the eastward, and anchor in 5½ fathoms, one-quarter of a mile North of *Nonsuch Island.*

In working up from the S.W. end to Castle Harbour ships may stand within a mile of the shore; and small craft until the bottom is seen. There are some small reefs and ledges along the line of shore, but they are very near the beach.

St. David's Head is next seen, in the form of a round bluff, covered with foliage, and, when the land is opened to the northward, a large cave will appear to view beneath the head. A reef extends from this bluff, about half a mile off shore; the sea generally breaks over it.

Vessels waiting for pilots may run in to the N.E. of the bluff, and heave-to with their heads off shore; the bottom is, hereabouts, visible, but no danger need be apprehended on that account.

The pilots are the most expert I ever met with. A good look-out is kept by the artillerymen stationed at the telegraphic hill, and delay seldom takes place.

Beyond St. David's Head the land trends to the N.W. *St. George's Harbour* (the best among the islands) is formed by several islands, and a curve in the larger island of the same name: its entrance lies between Fort Paget and a small kay to the eastward; the harbour is land-locked, well sheltered from the stormy West and N.W. winds, with a good depth of water over a bottom of stiff pipe-clay. The vicinity to the open sea alone gives it a decided superiority to the anchorage at Grassy Bay, if there were nothing else to recommend it.

ST. GEORGE'S ISLAND is "the military station of the colony, and formerly the seat of government; is about 3 miles long, and at no part exceeding half a mile broad; it lies at the entrance of the only channel for ships of burden. The harbour of St. George, when once entered, is said to be one of the finest in the world, and capable of containing the whole British navy. It is completely land-locked. The entrance to the harbour is narrow, and is protected by Cunningham Fort. After passing this entrance, the town presents one of the most beautiful landscapes the eye ever rested upon."

The ROADSTEAD, from whence ships proceed to St. George's Harbour, is called the *Five Fathom* or *Outer Hole:* within this is the *Inner Hole*, having a fairway buoy, *chequered black and white*, marking the entrance to the Narrows or Channel to Murray Anchorage, as well as being in the proper direction for crossing the bar. This buoy bears N. by W. from the rock under St. David's Head.

The *Five Fathom* or *Outer Hole*, where ships wait with winds not fair for going to Murray Anchorage, has from 5 to 10 fathoms. The mark for anchoring is the Cherrystone or Sugarloaf Hill (at the head of Mullet Bay) open of the old battery on the point of St. George's Island, bearing East by compass; St. Catherine's Point about W.N.W., and the rocks off Cooper's Island open of St. David's Head, S. ½ W.; but in letting go your anchor look out for a clear spot.

From the chequered buoy before mentioned, the passage over the bar to St. George's Harbour bears S. by E. ½ E.; the bar marks are, "a stone pillar and a white stake in a line, bearing about S. 20½° W. by compass (1851):" they lie on the slope on the North side of St. David's Island. Carry on this course until Smith's Fort on an island, which forms the South side of the entrance, bears S.W. by W. ½ W. and then steer for it, and when nearly up to it, bear round between it and the point, when the town will open on the starboard bow; whence you may proceed to the anchorage, keeping the N.W. shore on board. The passage over the bar is between two poles on the North side, and two on the South side. Four other poles mark the channel S.W. of this.

The depth on the bar is 16 to 18 feet; within it, and in the channel, 4 and 5 fathoms.

"At the entrance to, or on the bar of, St. George's Harbour, there lay a rock exactly in mid-channel, which was a great impediment to vessels entering. The reefs at the outer bar, half a mile from shore, are of a different nature to those in the narrowest part, which consists of a conglomerate of broken shells and sand, cemented by a limestone; it is here all of recent coralline formation. The greatest part are hemispherical masses, called here brain-stones (*meandrina labyrinthica*), in the cavities between which the diver places a canister of powder (usually 50 lbs.), which is fired by the galvanic battery. The greatest labour is in removing the fragments. This is done partly by the diver descending and slinging the broken rock, and partly by nippers used from boats. These operations are superintended by Lieut.-Col. Barry, Commanding R.E."—*Gov. Reid's Report*, Bermuda, March 16th, 1846.

The entrance to the *Jenkin's Boiler Channel* (14 to 18 feet) is South of the Outer Hole, and lies close to the shoal of that name. The mark for it is to keep the Whale House on the North side of Smith's Island, on with the Old Battery on the South side of Paget's Island (see the Chart), bearing about W. ½ S. Keeping this course about a quarter of a mile after passing to the North of the Boiler Shoal, will bring you on to the track above described.

High water, full and change, at St. George's, VIII½h. Common tides rise to about 4 feet, but springs, or in gales of wind, they frequently rise 6 or 7. The floods in the offing set to the N.E., and ebbs to the S.W., but near the shore they run in various directions.

"*St. Catherine's Bluff* is the north-eastern extremity of St. George's Island and of the isles in general. There is a fort upon it, and a battery for point blank shot. Beyond this head, to the westward, is *Murray Anchorage*, one of the most unpleasant places in the world to ride in during the winter season. I have been, for several weeks, riding out a N.W. gale in a frigate here, pitching bows under; and the *Driver*, sloop of war, is said to have carried away her bowsprit, in consequence of its getting under the cable, when she was in the act of plunging, during a gale here. The *North Rock*, at about 8 miles in the offing, appears from this anchorage, through a telescope, like a ship's boat, with three lug sails: there is a passage of egress for large ships through the reefs near the rock; but it cannot be attempted without a fixed leading wind: boats are then placed on either side of the channel to guide the pilot."—*Lieutenant Evans.*

MURRAY ANCHORAGE "lies on the S.W. side of Catherine Point, extending from Tobacco Bay to the Ferry, between St. George's and the Great Bermudas: whence, after going through a passage to the westward, there is secure anchorage from abreast of Brackish Pond, across the entry of the Great Sound, as far as Ireland. The common entry into Murray Anchorage is through an intricate and narrow passage round Catherine Point, called the *Narrows;* for the particulars of which see the Chart, as no description can be given here that will be of any use to a stranger. The ground in the entry, as well as all over the anchorage, consists of stone, of the soft dripstone kind, ground as fine as flour, mixed with a shelly substance, and a chalky clay: it is very heavy, therefore the anchors do not sink deep in it, and they loosen immediately when a-peak; but it is rarely that ships drive in it. I have, in the *Resolution*, a 74-gun ship, rode many heavy gales in this anchorage, but never started an anchor; although, in Hampton Road, Virginia, which has remarkably tough ground, the anchor has often come home. Ships bound for Murray Anchorage will generally get a pilot off Castle Harbour, or they may run as far as St. David's Head. When to the eastward of St. David's Head stand no farther to the northward than to bring the Head N.E., or you will see a white sandy bay to the southward of the Head, between it and Castle Harbour. In standing to the northward, care must be taken to shut no part of this bay in behind St. David's Head.

The West land of Bermudas will be shut in behind the land, over this bay, before this mark comes on. In the night, when waiting here for a pilot, the best precaution is the lead; for, if care be taken, and the ship is not running too fast through the water, you will be sure of striking ground in time to avoid danger."*—*Mr. Murdo Downie*, 1803.

The naval tanks lie abreast of Murray Anchorage, just above a small cove (*Tobacco Bay*), wherein is the landing-place. There is not a spring in the isles, and ducks are abundant. I had to remark at Nice (in Italy), where the earth is saturated with springs, that there was not a duck to be seen.

From the anchorage at Grassy Bay ships, unless they happen to be favoured with a leading wind, are generally one day working up to Murray Anchorage, a distance of 9 miles; and there they must wait until the wind proves fair, before they can get to sea round St Catherine's Bluff, and through the intricate channel which leads to St. David's Head. Even with a fair wind to or from Ireland Island (on which the new dockyard is situated) ships are liable to strike upon the heads of rocks everywhere scattered about: this happened to a ship I was in, with a most expert pilot on board; the weather being cloudy, the rocky spots did not show themselves sufficiently clear to be altogether avoided. —(*Lieutenant Evans.*)

DIRECTIONS FOR MAKING THE BERMUDAS, BY MR. MURDO DOWNIE, 1803.

Vessels in hazy weather, or in the night, must be very cautious in approaching, lest the wind or currents should set them on the reefs, or into some inextricable channel. Be particularly cautious in coming from the S.W., as upon the rocks off this end of the island, from S.W. to W.N.W., many ships have been lost. No stranger should attempt any of the anchorages without a pilot, many of whom are always on the look-out, and put to sea when a vessel heaves in sight. Their boats may be readily known, being of a peculiar construction and rig; of a light draught of water forward, with a long heel or deep sternpost; rigged with one mast and bowsprit, carrying a triangular mainsail, a foresail, and jib, and, occasionally, a gaff topsail and square-sail.

The prevailing winds with fine weather in these seas being from between the South and West, vessels from the West Indies and America generally make these islands by running in their latitude from the westward. The best latitude for that purpose is 32° 8', always having regard to a small probable current in the direction the wind blows: steering East, you will first see the land a little on the larboard bow, being two small sand-hills, close together, having a white house on the top of one, and cedar wood on the other (these are called Gibbs' Hills, now distinguished by the lighthouse before mentioned): as you near the land, you will see Wreck Hill farther to the northward, appearing peaked, and joined by low land to that first seen; steer to bring Gibbs' Hill to bear E.N.E., and, when within 6 miles of the land, take care it is not to the eastward of that bearing, because of the rocks called the Long Bar. Then steer so as to pass within 2 miles of the S.E. land; and, when Wreck Hill shuts in behind the South land, you are clear of the S.W. breaker, and may steer along the S.E. side of the island, at a mile distant from the shore, until abreast of St. David's Head, there being nothing to hurt a ship but what is in sight.

In running for BERMUDAS *from the eastward*, the best parallel is between latitudes 32° 10' and 32° 20'; in which a ship may run boldly, as there are no rocks at any distance from the land.

When running down a parallel for Bermudas, with a large wind, and not making the land toward night, but expecting to be near it, no vessel in this situation ought to lie-to, but should rather turn to windward, under an easy sail, until daylight, because of a probable current, as before mentioned, which has deceived many by bringing them unexpectedly among the rocks. The land not being high (Gibbs' Hill, on which is the light-

* The entrance to Murray Anchorage is regularly buoyed. From this anchorage ships may proceed south-westward to *Grassy Bay* or to *Ireland's Island*. On the latter is the naval establishment and dockyard, the general rendezvous for the king's ships. But this place is considered, by many of the pilots, as not having been judiciously chosen, the channel to it, from Murray Anchorage, having been reduced in width and depth of water by the influx of seaweed into the Great Sound on the S.W., and the rapid growth of coral: besides, ships of war have, at times, been detained here several days by the wind before they could get out to sea by St. George's Island.—*Cotter's Sketches of Bermuda*, 1828.

house, is the highest land in the islands), it cannot be seen at any great distance from a small vessel; add to this, the thick haze that frequently prevails here, particularly in fine weather, renders making the land somewhat difficult, and, at times, precarious, unless the latitude be accurately ascertained; for instances have happened of vessels missing the islands, and after a fruitless search steering for the American coast in order to take a fresh departure for running down the latitude again.

Instructions for Sailing to Bermudas Islands, by Admiral Murray.

Within the Gulf Stream steer well to the southward, perhaps as much as S.S.E., until you get within 3 or 4 miles of the latitude of Cape Hatteras; and then steer S.E. by E. until you get into the latitude of 32° 5′. Thus you will avoid crossing the Gulf Stream where it is very broad, and its direction far to the eastward, and pass it where it affects your latitude more than your longitude; and, of course, be of less consequence to the ship's reckoning: and, by steering thence so far to the southward as S.E. by E., you will fall into the latitude of the Bermudas, at 4 or 5 degrees of longitude to the westward.

You should by no means run for these islands unless sure of your latitude; and always make them from the S.W., if possible, looking out in time for the land, as, owing to the set of the Gulf Stream, and the general tendency of the currents to the eastward, ships from the coast of America will almost always be far ahead of their reckoning.

Having ascertained your latitude, and being well to the westward, get into the parallel of 32° 5′, and steer due East: this course will bring you to the islands, passing about 4 miles clear of the South end of *Chub Heads*, a very dangerous shoal, lying across the West end, about 8 miles from the land, with not more than 12 feet on it at low water; as well as the S.W. breakers, which lie about 1¼ miles S.S.W. from the southernmost land, being the shoalest part of a ledge of rocks of considerable length, lying parallel with the shore. Should the wind in the night incline to the northward, keep in 32° 7′ N.; but if to the southward, in 32° 2′.

The soundings do not extend more than 1½ miles from the shore on the South side; therefore, you have only a strict look-out to depend on for safety: and as for the East, West, and North sides, the breakers lie from 3 to 4 and 5 leagues off. You must avoid, by all means, running in the night, without having a good observation the preceding day, and being pretty sure of your longitude. Follow these directions, and you will first make Wreck Hill (which is high land on the western extreme of the islands), and the land trending from it to the S.E. Having passed the S.W. breakers, the land lies about E.N.E. and W.S.W., having danger no more than half a mile off, and that generally visible: you may run safely along shore at a mile, until you pass Castle Harbour, which is easily known by the castle on an island on the starboard hand. You should bring-to off the eastern point of this harbour, and wait for a pilot, who will soon come off, and carry you into St. George's Harbour. But should you be pressed for time, or the pilot not come off, you may haul round by the breakers, after having passed the islands which form the South part of Castle Harbour, into St. George's Road, bringing on the following marks:—

A high island, next to the N.E. part of the small ones off Castle Harbour, has, at its eastern extremity, a bluff rocky point, called St. David's Head, having breakers off it about half a mile; the northernmost land in sight, after you haul round St. David's Head, is called St. Catherine's Point; bring this point to bear W.N.W., and St. David's Head S. ½ W., and you will be in as good a berth as any in the road, with 7 or 8 fathoms of water; but in every part of these roads you must be guided by the eye where to drop your anchor clear of foul ground, which is everywhere easily seen, owing to the clearness of the water and the whiteness of the sand where the anchorage is safe.

In case you have been driven to the eastward of the islands (a situation, however, which you are to avoid with the utmost care), you may run for them in lat. 32° 14′ N., which will bring you to them 5 or 6 miles to the southward of St. David's Head, for which you may haul up upon making the land; but you are not to run in till you are far enough to the S.W. to follow the directions before given for coming from the westward, should you make sail for Bermudas from any part of the Gulf Stream, or without it.

I recommend you to make great allowance for your being to the eastward of your reckoning, and try to fall into the parallel of latitude above mentioned, in longitude 70° or 71° W.

High water at St. George's, full and change, 8¼ hours. Spring tides rise about 6 feet;

common, 4 feet. The tides are various, both in height and time, at different parts of the islands. The Bermudas bear from Cape Henry S. 63° 35′ E., distant 210 leagues.

Navigation to the Bermudas. (Lieut. Evans.)

"On the 12th of April, 1811, having left the frigate, I took charge of a prize schooner for Bermudas, and anchored at St. George's on the 6th of May following. On the 4th, at noon, in lat. 31° 44′, longitude by account 62° 10′, considering that we might be set to the West by current, I determined to get into the parallel of 32°, and then put the vessel's head to the eastward until daylight. By midnight we had run up a course N. 79° 45 W. 43 miles; which gave our situation, by account, 31° 52′ N. and 63° 3′ W. I left directions with the mid of the watch to tack at 12h 30′; and at that time the sand-hills were seen N.N.W. 9 or 10 miles: which showed that we were, by *account*, 1¼° to the East of the true longitude: the southern part of the land being in 64° 38′. I have no doubt we were set to the West by current, but something must be admitted for erroneous allowances, as we had often contrary gales and heavy seas to contend with. In a dark and dismal night, with very severe lightning and thunder (the schooner full of gunpowder), I recollect, whilst the wind was blowing a storm at North, that it shifted in a second to South, and nearly set us down: the gaff of the reefed foresail having caught between the ratlines of the rigging. We were lying-to on the starboard tack. I was therefore most happy when we dropped anchor in the snug harbour of St. George."

Remarks on the Bermudas, and Passages to and fro, by Mr. Edward Dunsterville, Master of H.M. Ship Ranger, 1830-31.

In July, 1830, from the Matemillo Bank, on the N.W. of the Bahamas, to the Bermudas, the winds prevailed from the S.E. to S.W. Light breezes and cloudy, with heavy rain at times. Found no current.

The Bermudas, from the S.W., at 5 leagues distant, appear as an assemblage of detached high islets, on the South part of which the signal-post on Gibbs' Hill is seen, being erected on the highest land in the islands. Hence we ran along shore, at 1½ to 2 miles off.

During our stay at these islands the winds prevailed for seven weeks from S.S.E. to S.W., which is invariably the case here during the summer months. Rise of spring tides about 3 feet 6 inches. High water at 6h.

When a signal for a pilot is made from ships in the offing, it is telegraphed by the signal-posts throughout the island.

To beat through the Narrows, near St. George's, it is requisite to steer from N.W. to W.N.W., and from St. Catherine's Point (the N.W. point of St. George) S.W. by S. and S.W., till Ireland Island bears about W. by N., whence haul to that course. In every course avoid all brown or dark patches, which are usually rocks, with little water on them. In the channel are from 6 to 7 fathoms. The buoys invariably point out all the rocky heads, which in some parts are numerous. In the latter end of September fine North and N.E. winds: the thermometer at 74°, which had been for the last two months from 80° to 84°. The *Ranger* anchored at Murray Anchorage in 10 fathoms, chalky bottom. St. Catherine's Point, E. ½ N. about 1½ miles.

The *Ranger* sailed from Bermudas for Jamaica on the 5th of October. Winds prevailing from the N.N.E. Fresh breezes and fine weather.

Winds light from the eastward until we arrived at Bermuda, when it blew strongly from the southward and westward for a fortnight. On the 11th of April anchored off Ireland Island. Vertical rise of spring tides here about 5 feet: neaps, 2 or 3 feet. High water at 8h.

Going through the Narrows at Bermuda.—In going in, the white buoys lie on the starboard side; the black on the larboard: of course, in going out, vice versâ. Fairway buoys are chequered, one at each entrance. The courses through are from W.N.W. to N.N.W. ½ W. The best anchorage at Murray Anchorage is in 8½ fathoms, off St. Catharine's Point, with the East signal-staff in St. George's S. by E. ½ E., off shore one-quarter of a mile. Between St. Catharine's Point and Mount Langton (the governor's house) keep the shore well on board; say one-quarter of a mile or less, passing in-shore of the buoys: but, when going through the Narrows, off the admiral's house, going between the buoys. In clear weather the dangers show themselves.

With these remarks on the islands by Mr. Dunsterville, the following, since made, may be included :—

"The land, generally, of these islands is low; yet there are many parts, as *Gibbs' Hill*, *Mount Langton*, the North part of *St. George's* and *St. David's*, that may be seen in clear weather 5 leagues off. The isles, as shown hereafter, are surrounded by most dangerous reefs, the S.E. side excepted, which may be approached within a mile, until abreast of the N.E. point, called *St. David's Head*. Off this Head pilots are readily obtained by displaying the usual signal. The government pilots may be known by a narrow blue burgee, with a broad arrow in white therein.

There is anchorage without the *Narrows*, on a spot called *Five Fathom Hole*, with St. Catharine's Point about W.N.W., and St. David's Head S. ½ W.; but, in letting go the anchor, look out for a clear spot.

In proceeding for the Narrows, the first buoy seen, which is chequered, is the leading buoy for the fairway. In the Narrows are 6 and 7 fathoms of water; here you leave the white buoys on the starboard, and the black on the larboard side.

If you intend anchoring in *Murray Anchorage*, bring St. Catharine's Point to bear East; the signal staff at St. George's S. by E. ½ E., in 9½ fathoms, chalk bottom, at a quarter of a mile off shore. From this anchorage to *Ireland Island*, where the men-of-war lie, is about S.W. by S. to abreast of Mount Langton, the governor's country residence, keeping the shore about one-quarter of a mile distant, and going with a leading wind in-shore of the buoys, which are placed on shoal corally spots. When Ireland bears about W. by N., you then haul for the island, passing betwixt two corally spots, nearly abreast the Admiral's house, which are both buoyed. In clear weather all the reefs are readily discerned, and may be avoided with a common degree of care. From Murray Anchorage to Ireland you have, in the channel, 7 and 6 fathoms.

During the summer months, from April to September, the winds prevail from S.S.E. to S.W. Thermometer, 80° to 84°. About the latter end of September the northerly winds set in, when the thermometer falls to 70° and 74°; quite a bracer for the constitution. The rise of tides at springs is about 5 feet, neaps 2 or 3 feet. High water at Ireland, full and change, at eight o'clock. The tide at the narrows sets from 1 to 2 miles in the hour.

The height of Gibbs' Hill signal station is about 200 feet: of Wreck Hill about 150. On the S.E. side is a large space of sand, called *Sand Hills*, which is very remarkable. The North Rock is about 16 feet high, 20 feet long, and 6 feet wide: here the currents are strong and very variable, but mostly to the eastward in the offing.

A branch pilot has 3s. per day, with allowance of provision, and one dollar per foot for any government ship.

Directions for Sailing near the Bermudas, on coming from the Westward.

"On coming from the westward, the S.W. points of the land ought to bear E.N.E. before you come within 4 leagues of the land, when you may steer directly for it, without danger. The breakers, on the South side, always show themselves; so that a a ship may safely approach within gun-shot from the S.W. end to the S.E., and, when getting to the eastward of the castle, round into St. George's. Do not go farther to the northward than to keep Cooper's Island open within St. David's Head, till you take a pilot; and the subscriber engages no ship will ever strike, if this be attended to."—*Thomas Lean*, 1808.

On the Winds and Navigation of the Bermudas, by His Excellency Colonel Reid,* Governor of Bermuda.

The first half of a revolving gale is a fair wind from Bermuda to New York, because in it the wind blows from the *East;* but the last half is a fair wind from New York to Bermuda.

* "On the Winds as influencing the Tracks sailed by Bermuda Vessels; and on the Advantage which may be derived from sailing on curved Courses, when meeting with progressive revolving Winds, *by Governor Reid, of Bermuda* (Author of the '*Law of Storms*')."—*Edin. New Phil. Journal*, July, 1846, p. 102.

During the winter season most of the gales which pass along the coast of North America are revolving gales. Vessels from Bermuda bound to New York should put to sea when the N.W. wind, which is the conclusion of a passing gale, is becoming moderate, and the barometer is rising to its usual level. The probability is, more particularly in the winter season, that, after a short calm, the next succeeding wind will be easterly, the first part of a fresh revolving wind coming up from the S.W. quarter.

A ship at Bermuda, bound to New York or the Chesapeake, might sail whilst the wind is still *West*, and blowing hard, providing the barometer indicate that this West wind is owing to a revolving gale, which will veer to the *northward*. But as the usual track which gales follow in this hemisphere is northerly, or north-easterly, such a ship should be steered to the southward. As the wind at *West* steers towards *N.W.* and *N.*, the vessel would come up, and at last make a course to the westward, ready to take advantage of the *East* wind at the setting in of the next revolving gale.

A vessel at New York, and bound to Bermuda at the time when a revolving wind is passing along the North American coast, should not wait in port for the westerly wind, but sail as soon as the first portion of the gale has passed by, and the N.E. wind is veering towards the *North*; provided it should not blow too hard. For the *North* wind will veer to the *westward*, and become every hour fairer for the voyage to Bermuda.

A great number of gales pass along the coasts of North America, following nearly similar tracks, and in the winter season make the voyage between Bermuda and Halifax very boisterous. These gales, by revolving as extended whirlwinds, give a *northerly* wind along the shore of the American continent, and a *southerly* wind on the whirlwinds' opposite side far out in the Atlantic. In sailing from Halifax to Bermuda it is desirable for this reason to keep to the westward, as affording a better chance of having a wind blowing at *North*, instead of one at *South*; as well as because the current of the Gulf Stream sets vessels to the eastward.

When vessels from Barbadoes, or its neighbouring West India Islands, sail to Bermuda on a direct course, they sometimes fall to the eastward of it, and find it very difficult to make Bermuda when westerly winds prevail.

They should therefore take advantage of the trade-wind to make the 68° or 70° of West longitude, before they leave the 25° of latitude.

On a ship leaving England for Bermuda, instead of steering a direct course for the destined port, or following the usual practice of seeking for the trade-winds, it may be found a better course, on the setting of an *easterly* wind, to steer West, and if this wind should veer by the *South* towards the West, to continue on the port-tack, until, by changing, the ship could lie in its course. If the wind should continue to veer to *North*, and, as it does sometimes, even to the *eastward of North*, a ship upon the starboard tack might be allowed to come up with her head to the westward of her direct course. On both tacks she would have sailed on *curved lines*, the object of which would be to carry her to the westward against the prevailing wind and currents. There is reason for believing that many of the revolving winds of the winter season originate within the tropics; and that ships seeking for the steady trade-winds, even further South than the tropic, at that period of the year, will frequently be disappointed. How near to the equator the revolving winds originate in the winter season, is an important point not yet sufficiently observed. The quickest voyage from England to Bermuda, therefore, may perhaps be made by sailing on a course composed of many curved lines, which cannot be previously laid down, but which must be determined by the winds met with on the voyage. This principle of taking advantage of changes of revolving winds, by sailing on curved lines, is applicable to high latitudes on both hemispheres, when ships are sailing westerly.—*Government House, Bermuda, 21st March*, 1846.

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9. THE COASTS AND ISLANDS OF AMERICA, IN GENERAL.

For a complete and correct description of the Coasts of Newfoundland, of the Gulf and River of St. Lawrence, the Coast of Nova Scotia, &c., to Cape Cod, the reader is referred to the BRITISH AMERICAN NAVIGATOR, published by the Proprietor of the present work. The navigation thence to the southward, including the whole of the West Indies and Mexican Sea, is described in THE COLOMBIAN NAVIGATOR.

As these have been lately revised, the Editor has little to add to the instructions already given. The American navigation, in general, requires details so minute, and explanations so copious, as to render it impracticable to do justice to the subject in an abridgement; and he does not pretend to attempt it, being convinced that it would not answer the desired purpose.

The general explanation of the passages over the Atlantic to America and the West Indies, as given in the preceding part of this work, show how these passages are controlled by the prevailing winds and currents; and how the general courses should be regulated in the different seasons. All, therefore, that we have now to add, is the situation of the dangers to be avoided in making those passages; and this will be found attempted in the following section.

SECTION IV.

DESCRIPTION OF THE ROCKS, SHOALS, AND VIGIAS,* IN THE ATLANTIC; AND OF THE AUTHORITIES ON WHICH THEY HAVE BEEN INSERTED IN THE CHART: INCLUDING REMARKS ON ICE-BERGS, ICE ISLANDS, ETC.

General Note on the Vigias, &c.—This section may, with propriety, commence in the words of M. de la Rochette, who has said, "We take upon us neither to certify the existence nor the position of all these vigias; as it is extremely possible to mistake one for another, or to repeat them, especially those of which the position depends on the estimate or guesses of mariners.

"It is, moreover, possible that navigators, at a certain distance, may have mistaken whales for shoals. M. de Chabert, in his voyage to America, in 1741, for the purpose of making astronomical observations, being at the distance of 70 leagues from Corvo, one of the Azores, descried a dusky body, over which hovered a number of gulls, a bird seldom seen at such a distance from land; at first he imagined it to be a rock, but on coming near, in order to observe it, he found it to be the carcase of a whale, of monstrous bulk. Besides, some of those vigias may have ceased to exist, after having appeared for some time; as, for instance, the island which rose out of the sea in the year 1720, to the westward of St. Michaels, of the Azores, and which disappeared again on the 17th of November, 1723."

As a monition against too hastily forming conclusions from mere appearances, we here add, that an old friend of ours, in crossing the Atlantic, was once alarmed by the sight of breakers at no great distance. Instead of coming home with an imperfect report, he very properly sent out a boat to examine them, and found that they were caused by a floating body, thickly covered with barnacles, &c., to which a hatchet was applied, and soon disclosed a cask of wine, which proved to be excellent Burgundy. It had, no doubt, been floating many years, and during the time had probably been the prolific parent of a number of *vigias*, &c. On the 4th of August, 1822, Captain Hamlin, in the brig *Recovery*, likewise picked up a hogshead of claret wine, that had been a long time in the water, and worm-eaten nearly through, lat. 34° 51′, lon. 24° 51′.

We have shown, in another work, how easily an animated as well as a lifeless being may be mistaken for a rock. In 1818, the *Northampton*, Captain Tebbut, on her passage to India, had passed the meridian of the Cape. On the 1st of August, at noon, the ship was in lat. 40° 45′ S., and lon. 24° 32′ E. On the next day an object appeared right ahead, like a boat; on nearing, it looked like the wreck of a vessel, *two parts being above water*, at two ships' length from the lee-bow. The barnacles could be distinguished by the naked eye; but, when abeam, the creature *went down*. It proved to be a *thrasher*. Captain Tebbut says, "Being forward at the time we came up with the animal, the two parts above water seemed to me like a wreck, bottom upward. When I first saw the barnacles, the part covered with them looked rugged, and I was firmly of opinion that it

* Vigia is a Spanish word, literally signifying *Watch*, or *Look-out*. It is generally, in the charts, attached to spots supposed to be dangerous, and which should, therefore, be approached with caution.

was a rock above water; so much so, that I looked over the lee-bow to see that we were clear of it, ordering the man to starboard the helm."

A similar instance has been recorded in the *Journal of the Royal Geographic Society*. "A frigate was one day running into the Rio de la Plata, with her studding-sails set, when the look-out man at the mast-head reported breakers on the bow. The captain, believing that such a danger could not have escaped the notice of the Spaniards, and having, also, a tolerable chart of the river, suspected it must be some floating object, and ordered the ship to be steered directly for it. The officers were on the alert; glasses were frequently directed to the spot, and all concurred in representing it as a rock a little above water. Anxious looks were directed to the captain, whom they now considered as unnecessarily running into danger; but that officer kept carefully watching his approach, and, as the studding-sail boom was just over it, the cetaceous monster (for such it was) hastily made off; and, rising again to blow, finally disappeared. It was observed to have an excrescence on its back, covered with shell-fish. The sea broke gently on its weather side, and appeared becalmed to leeward; and so perfectly did it resemble a rock, that, had the vessel passed at a distance without disturbing it, there can be little doubt but it would now have had a place upon the list of vigias.

"It is to be observed, in this case, that there was only a little ripple about the body, but no breakers; and this circumstance had not escaped the intelligent eye of the commander."

The *dead* carcase of a whale may even approach nearer in appearance to a permanent danger than a living one. Captain Vidal, in H.M.S. *Styx*, while passing from Terceira to St. Michael's, on July 20th, 1844, the mast-head man reported the appearance of breakers on the starboard bow; the wind was West, and there was a little swell. "With our glasses we saw what appeared to be a small sand-bank, such as forms the crowns of some of the coral banks in the eastern ocean, and there appeared, particularly on its southern margin, to be a few breakers. Finding the vessel could not fetch it, I sent the master in the gig to ascertain what it really was; and it proved to be the carcase of a whale, from which much of the blubber had been taken, but some, only partially severed, lay floating by the side, and, by the undulation of the waves, presenting the appearance of breakers. Now, I have no hesitation in stating, that this object so much resembled a sand-bank, or, it might be, a tide-rock at low water, that had I left it unexamined I should certainly have reported the probability of its being either one or the other, and, in so doing, I should have added another vigia to those which disfigure the charts of the North Atlantic Ocean."*

Captain Wilkes, of the United States Expedition, gives the following instance:—

"The 5th of September, 1838, being near the reported shoal of St. Anne, I determined to pass over its position.

"On the 6th, we passed over it; the sea was smooth, the horizon clear, and the day beautiful. At eight, a.m., the look-out cried out, 'Rocks, or a wreck, on the starboard bow!' which at once created an excitement on board. We stood for it. It had, at first, every appearance of a rock, then that of a wreck with the masts gone. It proved, however, to be a large tree of cotton-wood, 120 feet in length, and 14 feet in circumference, at the height of 5 feet from the roots. It had been a long time in the water, was full of barnacles, and much eaten by the teredo navalis. Great quantities of fish were about it, consisting of dolphins, sharks, &c. We did not, however, succeed in taking any. In rough weather it might easily have been mistaken for a rock, particularly if passed in twilight, or at night. There is little doubt in my mind that many of the numerous vigias that appear in our charts have as little foundation. No current was experienced hereabouts, and I am led to the conclusion, that a sort of eddy or still water is here found, wherein most of the wood carried by the Gulf Stream becomes deposited for a time. On the 8th, we were in lon. 34° 8′ W., lat. 37° 17′ N."

In every event, however, it is always the safer course, in matters of this nature, to err rather by marking too many than too few; especially when we make known, as we have done, the authority that we rely on for the existence of each. Every one, of course, is free to act according to his own judgment.

* *Nautical Magazine*, 1844, p. 579.

1. TO THE NORTHWARD OF LATITUDE 50 DEGREES.

NUN ROCK, off CAPE RATH, in lat. 58° 52½′, lon. 4° 56′ W.

This rock, with the adjacent bank, was surveyed, under an Admiralty order, by Captain Ramage, in the *Cherokee* sloop of war, 1817. According to Captain R., from the centre of the rock, over which there is but 15 feet of water, at low ebbs, Cape Rath bears, by compass, S. 32° W., nearly 15 miles; Farout Head, S. 10° W., 18 miles; Whiten Head, S. 6° E., 21¼ miles; the Stack, S. 85° E., 14 miles. For a further description of the rock and bank, see our *Memoir on the Northern Ocean*, page 14.

AITKIN'S ROCK, to the West of the N.W. of IRELAND?*

The original notice relative to this danger, or *imaginary danger*, was published at Whitehaven, 12th of September, 1740. On the 16th of July, at seven o'clock at night, in a passage from Virginia, on board the *Friendship*, of Ayr, John Aitkin, master, James Lockhart, mate, coming in at the N.W. channel of Ireland, going under reefed foresail, wind at N.N.W., steering E. by S., saw, by the weather-leech of the foresail, a rock under water, about 4 feet, distant 40 or 50 yards, to the best of judgment, the ship running 6 knots by log, with a heavy swell from the N.W.; all hands being on deck saw it plainly: next morning made the land, betwixt Insterhul and Tory Island, at about eight o'clock. Supposed to lie in the latitude of 55° 18′ N., and longitude, from the meridian of London, 11° 14′ W. From Tory Island, West, distant 94 miles, without allowance of variation.

A second advertisement, relative to this rock, was published by Mr. F. Cumming, of New York, in the year 1793. "On Thursday, August 9th, 1722, ship *Nestor*, of Greenock, from New York, bound to Greenock, being in latitude, per observation, of 55° 19′ N., and longitude, per account, of 9° 53′ W. of Greenwich. The officers, passengers, and ship's company, who were then on deck, perceived a rock about 4 feet below the surface of the water, not 5 fathoms from the weather-beam of the ship, in the form of a horseshoe, with one side longer than the other: the mate instantly threw an empty barrel overboard; the yawl was got out as soon as possible, and the mate, four hands, and two passengers went into the boat, and were absent near two hours in search of the rock; but, owing to the ship's drift, and a dark cloud which then obscured the atmosphere, they could find neither rock nor barrel. The Rev. Mr. Stewart, then a passenger in the *Nestor*, saw the rock plainly, with the tangle growing on it.

"We have other accounts of this rock, and of these, one states its position at 55° 15′ N., and 10° 40′ W.; a part appearing at 3 feet out of the water, with sounding of 30 to 40 feet a short distance; at 30 fathoms off, no soundings with a line of 150 fathoms. In or about the year 1804, Captain Clarke, since of the *Harmony*, of Ayr, believes that he saw the rock very distinctly; by his run, it appeared to lie 20 leagues nearly true West from Tory Island. He thinks it is from one half to a whole cable's length long, and about 150 feet broad. The tangle appeared about 1 foot below the surface, at about dead low water, and the ship rubbed alongside the rock.

"In the *True Briton*, Wednesday, the 27th of September, 1826, when steering E.S.E., a man at the mast-head called out that there were breakers close to our larboard bow. I immediately hauled the brig up S.S.E. to clear them. In the run of the sea, a rock appeared a little above the water, nearly flat, about 90 feet long, and 40 broad; saw no breakers, excepting round the rock, and could distinctly see the sea working over the rock. We sailed from the rock 11 miles S.S.E. per compass, and ob. m. lat. 55° 17′ N. We then bore up E.S.E. 36 miles, and E. by S. 6 miles, when Tory bore, per compass, S.W. ½ W. 1½ miles.

"*Greenock, October* 8, 1826. JAMES REID, *Commander*."

Iver M'Iver, a rigger in Greenock, stated (in 1820) that many years before, while he was seaman on board a vessel, they fell in with Aitkin's Rock in fine weather. The captain caused the boat to be got out, and M'Iver was one of the men in the boat. He said the rock was not much under water, had seaweed on it, and was about the size of a ship's launch, bottom upward.

Several other accounts of this rock have been given, as seen from different vessels; and in consequence of all, the Chamber of Commerce of Glasgow addressed a letter to the Admiralty in 1821, stating that no less than six vessels were missing from that port, and

* In this section the note of interrogation [?] implies, that either the position or existence of the shoal is doubtful.

soliciting their lordships to cause an examination of the danger. The application was renewed in 1826 and 1827. In consequence, H.M.S. *Gannet* was on this service in 1824, the *Harrier* and *Badger* in 1827, and the *Pylades* and *Dispatch* in 1829; but the rock was not discovered.

Again, in 1830, the *Onyx* and *Leveret*, two gun-brigs, commanded by Lieutenants Dawson and Worth, and directed by Captain A. T. E. Vidal, were engaged on this service. "They put to sea on the 6th of June, when the moon was at the full; and, commencing their examination at Tory Island, proceeded nearly along its parallel of latitude to the westward of all the given positions of the rock. The two vessels were always in company, and the general practice was to sail on parallel lines, distant from each other from 1 mile to 1½ miles by day, and closing at night to half a mile, or as much less as the state of the weather rendered necessary. During the few hours of darkness experienced at that season of the year, the vessels were hove-to, that no part of the suspected ground might be passed unseen, and the leads were kept going, both day and night, from the depth of 150 to 200 fathoms. Their distances from each other were determined every hour by the angle of elevation subtended by their respective masts, at the heads of which balls had been placed to facilitate the measurement. Their mutual bearings were taken at the same time; and men were kept constantly at the mast-heads during the day, and a vigilant look-out preserved through the night.

"The parallel of latitude of Tory Island, as before mentioned, was first carefully examined to the westward of all the positions of the rock, and then traversed back again. These runs were laid down on the chart, and then other lines traced, until the whole space was explored as there exhibited. This system of crossing and re-crossing over every part of the suspected ground was persevered in until the 31st of August; when, having visited every position assigned to this danger, and indeed the whole space comprehended by them, without seeing any rock, or discovering any detached bank, which could indicate its having existed, the search was relinquished, and the vessels returned to England."

To those, hereafter, who may have to make similar researches, it may be important to know that *Captain Beaufort* (Hydrographer to the Admiralty), in his instructions, had recommended that the vessels should sweep for the rock by laying out a large scope of hawsers between them, and drifting with it over the suspected ground. To effect this, he suggested two methods:—the one, when the two vessels should be on the same tack, the leading brig keeping a little off the wind, with her main-topsail occasionally lifting; the hawsers fast to her quarter, with a spring to them from her weather-bow; the sternmost brig lying-to, with her main-topsail to the mast, the hawsers from her weather-bow, and a spring to them from her weather-quarter. The other method Captain Beaufort proposed was, drifting on opposite tacks, the hawsers fastened to their sterns, with springs to them from the weather-bow of each vessel.

An additional number of hawsers were accordingly provided for the purpose; and, upon the principles described, a line of them, amounting to more than 700 fathoms, was laid out, and a large portion of the suspected ground subjected to this mode of examination. To prevent the central part of this long scope from descending to too great a depth, and to relieve the vessels and hawsers as much as possible from the strain required to keep so much heavy rope in proper tension, the hawsers near the middle of the line were buoyed, at intervals, with empty water-casks.

Every part of the suspected ground was run and sounded over in open daylight, through the different phases of the moon, at all times of tide, and under every variety of wind and weather. Great pains were taken to explore it during the spring-tides, when it might be expected to be uncovered; and, in short, the utmost digilence was exerted to bring this examination to successful termination. This search, however, has failed to produce the rock; and *though it is not presumed to assert that it has no existence*, yet it is hoped that a reference to the chart will justify the statement, that it cannot occupy any of the situations assigned to it.

During the month of June many of the mast-head men and others were momentarily deceived by the blowing of whales, which at that time were numerous; and in August a small black object, a little above the surface of the sea, was productive of similar hope and disappointment. It was first seen from the *Leveret*, and, on examination, proved to be the trunk of a very large tree, with its roots projecting two or three feet out of the water. They were covered with weeds, barnacles, and other marine productions; and, presenting a rounded top, abrupt on one side and sloping on the other, corresponded very

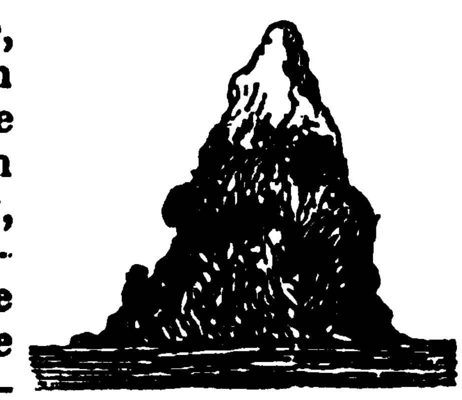
minutely with one of the descriptions of the rock.—*Journal of the Royal Geographical Society*, vol. i., pp. 51 to 58.

"Captain Vidal's researches do not convince me that Aitkin's Rock *does not exist;* for I have no doubt of M'Iver having told the truth, and Captain Clarke is a man above suspicion; but it is very easy to pass a speck like it very close, and not see it, particularly at or near high water."—*Andrew Livingston.*

BRASIL ROCK, in lat. 51° 10′, lon. 16°.

M. Bellin, in his Memoir of 1742, states that this rock is marked in lat. 51°, and lon. 19° 30′ from Paris, according to Brouage, hydrographer, and Laisne, a pilot. It has been variously represented in different charts, although its existence has been doubted. Messrs. Verdun and Borda have added to their remarks upon this rock, that they do not believe it to exist. It was, however, seen in the year 1791, by the company and master of an English merchant ship, the commander of which favoured the editor of the present work with a description of it, stating that it is really a high rock, or islet, apparently bold-to, and to which he passed so near, that he could have cast a biscuit on shore. The longitude, according to his computation, was about 16° W., but we suspect that, *if it exists*, it is more to the westward.

ROKOL, or ROCKALL; about lat. 57° 37′, lon. 13° 36′.



Appearance of Rokol, 2 miles distant, as taken by the late Mr. Harvey.

This is a large and high rock, of a conical or sugar-loaf shape, the summit, or upper part of which is perfectly white, from an immense quantity of birds' dung, with which it is covered. The rock has been seen many times, but its true situation was unknown till the year 1810, when it was ascertained by Mr. T. Harvey, master, and the other officers of the *Endymion*, frigate, commanded by the Hon. T. B. Capel. By the observations made by these gentlemen, on the 8th of July, it appeared that the longitude, per mean of 11 lunars, was 13° 30′ W., and the latitude, per meridian altitude, 57° 40′ 10″. On the 8th August, the longitude per mean of three chronometers appeared to be 13° 29′ 30″; by mean of five lunars, 13° 34′ 19″: and the latitude, per meridian altitude, 57° 38′ 54″. In Captain Vidal's chart of the western banks it is represented in 57° 35′ N., and 13° 40′ W.

With the rock bearing N. by W., broken water appeared about a mile to the N.E. of it; and, on approaching nearer, a rock, on which the water broke, appeared just at the water's edge. When due South of Rokol, the breakers were in a line with the eastern part of it. The variation of the compass, according to observations now taken, was 33° 35′ W.

The following remarks on Rokol were communicated to the public by Mr. Richard Peacock, in 1809:—"This rock appears almost like a ship at a distance, and is steep close-to on the North side. I have passed at the distance of about 50 fathoms; but, to the southward, or nearly S.E. by E. from the rock, there lies a long reef of rocks for about 3 miles. On this reef, with gales of wind, the sea breaks very heavily.

Captain Osborn, of Workington, told me that, on his passage from Quebec, in 1806, it was with the utmost difficulty he escaped getting amongst the breakers. Captain Magee, of Greenock, also informed me, that he had seen the sea break to the distance of nearly 3 miles in a S.E. direction from the rock."

Helen's Reef, to the N.E. of Rokol.—On a reef, until then unknown, and lying about 2 leagues, or less, E.N.E. ½ E. (by compass) from Rokol, the brigantine *Helen*, of and from Dundee, struck fatally, on the 19th of April, 1824. This vessel, commanded by Mr. Thomas Erskine, was bound to Quebec and Montreal, with a general cargo, and after she had struck, the crew and passengers continued at the pumps for 13 hours; but, being overcome with fatigue, were at length compelled to abandon the vessel, as the leak was rapidly gaining on them, the water being within 3 feet of the hold beams. When lowering the long-boat, she unfortunately was stove in pieces against the vessel, with a tremendous sea. The crew, at that period twelve in number, embarked in two boats, with one passenger, and soon after they had left the vessel she sunk, when sixteen passengers perished, of whom seven were women, and six children. The crew were picked up at sea by the bark *Flora*, Captain Baker, from Dantzic to Liverpool, and safely landed on the Isle of Tiree, one of the Hebrides.

It appears, from Captain Erskine's narrative, that he estimated Rokol to lie in 13° 40′ W.

That the vessel struck twice on a clump of rocks, apparently not much bigger than a ship's length, and on which the sea broke occasionally. No other breakers were in sight at the time. Rokol at this time bore, by compass, W.S.W. ½ W., he thinks about 6 miles distant; but, as the weather was hazy, probably something less.

Another intelligent person has related that he had, about two years before, fallen in with the breakers to the S.E. of Rokol, which appeared to extend outward 3 or 4 miles, in clumps, at some distance from each other.*

The ROKOL BANK has been surveyed by Captain Vidal. The edge of the bank of soundings, comprehending less depth than 100 fathoms, is 20 miles to the northward, and 35 miles to the southward of the rock; and the least depth expressed, which is on the S.W. of the rock, is 54 fathoms. The whole extent of soundings from N.E. to S.W., within the depth of 200 fathoms, is 55 leagues.

The greatest breadth, which is on the parallel of 57° 30′, is 18 leagues. The North end of the bank, with 163 fathoms of water, is in lat. 58° 19′, lon. 13° 40′; and the S.W. end, with 180 fathoms, is in lat. 56° 3′, lon. 15° 59′. *Magnetic variation*, on the centre of the bank, in 1831, 33° W.

LION'S BANK, in lat. 56° 40′, lon. 17° 45′.

This bank was sounded by Lieutenant Richard Pickersgill, in the brig *Lion*, in 1776, who found upon it from 290 to 320 fathoms. A vast quantity of sea-fowls were over it, and it probably abounds with fish. The position annexed is that given in the Requisite Tables. Dr. Forster, in his "History of Voyages made in the North," says, "On the 20th of June, with 320 and 290 fathoms, Pickersgill found a sandy bottom, in 56° 38′ N., and 17° 44′ W., which induced him to call that spot *Lion's Bank*; and particularly so, as he found there, what is usually seen on all banks at sea, a vast quantity of sea-fowl, such as gulls, dumdivers, &c. Soon after this, he could no longer get any soundings, nor were there any more fowls to be seen. This bank is said to have been sounded on, a few years ago, by Captain Richmond, of Greenock.

KRAMER'S BANK, in about 60° 57′ N., and 16° 40′ W.?

This bank appeared in M. Bellin's Chart of 1751, and was probably copied from the Dutch charts of the Greenland seas, which represented it as of considerable extent. It is said to have been discovered by Captain *Alof Kramer*, but whether dangerous or otherwise we know not. Captain Ross sought for this bank, but unsuccessfully, in 1818. This gentleman says, "Continuing our course, we came, on the 8th of May, to the spot where a bank is laid down in *Steel's Chart*, as discovered by *Alof Kramer*, but we could find no soundings in 130 fathoms, anywhere on or near the place." It may safely be erased from the charts.

N.E. LEDGE of BELLE ISLE.—Captain Cook, in his directions, which accompany the *North American Pilot*, has observed, "that ships steering for this island should be careful to avoid a ledge of rocks that bears N.E. ½ N. [*about N. by E.*] from the East point of

* Extract from the log-book of the *Emperor Alexander*, of Aberdeen, L. M'Kinnon, master.—April 8th, 1832, saw Rockall [Rokol] bearing W.N.W., distant 4 leagues; and Long Reef, breaking occasionally, bearing from the ship N.W. by W. ½ W. (by compass), distant 8 miles, and about 4 miles from Rockall. At intervals the sea did not break on the reef, but it broke frequently very heavily, and with long rolling white seas, like breach upon a bar, for about 6 or 7 ship's lengths. The sea broke in no other place at that time within sight.—*Nautical Magazine*, December, 1833, p. 697.

Breakers were again seen, in 1844, by Mr. R. Bartlett, of the *Guide*. The following particulars appeared in the *Shipping Gazette*: "On 15th April, 1844, at 4 a.m., sighted Rockall, bearing N.W., ship lying N.W. by W., strong gales from the S.W. by W., clear weather; was desirous to keep my reach to the N.W.; not being able to weather Rockall, bore away to round the North end: had my mate aloft and myself on deck to look for breakers; suddenly I found the vessel between the outer rock and the main one, at least 8 miles distant; with difficulty I cleared, by hauling the ship suddenly on the starboard tack, being not more than one sea from the broken water; breaks occasionally. They are bad to discern aloft, but their locality may be seen much more readily off deck by the colour of the water. The morning being clear, I was able to obtain the bearing and distance pretty correctly." This reported clump of hidden rocks, about 80 or 90 feet in length, and 30 feet in breadth, the main rock on Rockall, bearing from the outer one, W. by N., by compass, distance 8 miles, may, perhaps, have the same origin as the previous account. Captain Vidal has minutely surveyed the whole of that part, and no shoal or rock was discovered by them.

the island, distant 2 miles. Part of these rocks appear above water, and the sea always breaks upon them. You will have 20 fathoms close to them, and 56 between them and the island. All about this island are irregular soundings; but you will not find less than 20 fathoms home to the island, excepting on a small bank, lying N.W. by N. 4 miles from the N.E. end, whereon it is said are only 5 fathoms." Upon these rocks, &c., the icebergs are frequently aground, and completely obstruct the navigation of the strait.

BETWEEN THE LATITUDES OF 40 AND 50 DEGREES.

ICEBERGS, ICE ISLANDS, AND DRIFT ICE.

Although we have, in a former work,* noticed the annual floats of ice which descend from the northern regions, it may not be inapposite to recall to the seaman's mind the necessity of guarding against these tremendous and dangerous objects,—more dangerous than permanent rocks, because unfixed, and more dreadful, because frequently obscured in snow and fog. They have been generally found on and to the eastward of the Newfoundland Bank, and between the parallels of 40° and 50° N.

"It has often been asked," says Dr. Mitchell, "whence this uncommon and prodigious quantity of ice proceeded? There is one circumstance relative to it, rendering it highly probable that it comes from the Arctic Sea, and regions of ever-during frost. The consideration is this: that these immense bodies are veined or streaked with zones or layers of transparent ice, white ice, green and blue ice, sleet and compacted snow, disposed one above another, in such succession, and to such height, as cannot be reasonably supposed to be the accumulation of one winter. They are manifestly the effect of many years' congelation. In the course of 10, 20, or perhaps 100 years, or even more, such a composition may be formed, from the ordinary freezing of water below, and from the addition of snow, sleet, and rain, successively above. When such a pile becomes top-heavy, a fragment of it, descending to the adjacent ocean, may form an *ice island*, if it be solid; or, if softer or more friable, be spread over a large surface, in the form of *field ice*."

Captain Scoresby, whose opinion is invaluable, and may be considered as setting the question at rest, observes, "that, however dependent the ice may have been on land, from the time of its first appearance to its gaining an ascendency over the waves of the ocean, sufficient to resist their utmost ravages, and to arrest the progress of maritime discovery at a distance of, perhaps, from 600 to 1,000 miles from the Pole, it is now evident that the proximity of land is not essential, either for its existence, its formation, or its increase."

Concerning the production of land ice, there have been many observations recorded, and an important branch of geological science has been based upon it, termed the "glacier theory." It is well known how that the icy cliffs of Greenland, Spitzbergen, and the other circumpolar lands, "calve;" that is, having by their increase become too heavy and large for their original support, break off, and thus form immense floating icebergs and fields. It is probable, that the ices which are met with at sea may contain internal evidences of their origin, whether from the land, and from fresh water, or from the sea. Sea ice is porous and opaque, and whatever salt it contains is lodged between the parts of which it is composed; and hence results the peculiarity, long since observed by Daines Barrington, that when melted without being washed, the water was saltish.†

It would be out of place to enter into detail upon this subject, but from the above-

* "*Memoir on the Northern Ocean*," &c., p. 61. On the origin and nature of the ices, see the same work, pp. 51 to 57.

† Transparent ice, free from interior spaces or bubbles, is one of the purest substances in nature, and it is not possible to detect the presence of the minutest portion of air, or any substance that may have been held in solution by the water from which it is formed. The strongest poisons, or colouring matter of any description, are most effectually separated from water by the process of freezing it. This must, of course, only be understood to refer to those masses which are quite clear and transparent, or the spaces or vacancies left in the ice will naturally contain portions of the adventitious matter. Ice, therefore, is one of the best sources from which a supply of fresh and wholesome water can be obtained, and if these hollows be washed in fresh water, ice water will be found preferable to, and purer than, any other.

mentioned work, as well as those of Captain Scoresby and others, much interesting matter may be gleaned. We must, therefore, consider them here as only affecting navigation.

There is one subject with which the presence of ice is intimately connected, and that is the currents; but, as these have been fully explained in a former part of this work, the reader is referred to that portion of the book. It is shown, on page 193 *et seq.*, that there is a general and powerful southerly current setting through Davis's Strait and from the Polar Seas; these currents, passing along the coasts of Labrador and Newfoundland, bring with them, at times, immense quantities of ice, which is distributed over the Grand Bank and its neighbourhood; and this ice has been found as far South as lat. 36° 10′, or 7 degrees lower than the tail of the Banks, and to the *southward of the Gulf Stream.*

Mr. W. C. Redfield, to whom the world is so largely indebted for his researches in meteorology and physical geography, has recently published a pamphlet, accompanied by a chart, upon the ices of the North Atlantic. In this he has clearly shown that the Gulf Stream *passes over* the cold Arctic Current, which transports the deeply immersed icebergs into and across it. "No impulsion but that of a vast current, setting in a south-westerly direction, and passing beneath the Gulf Stream, could have carried these immense bodies to their observed positions, on routes which cross the Gulf Current, in a region where its average breadth has been found to be about 250 miles." Other observations on this subject have been given on pages 242 to 244. The same influences will also cause the presence of floating ice in the Gulf of St. Lawrence, by carrying it through the Straits of Belle-Isle; but the depth of this would prevent the progress of the larger icebergs.

It need scarcely be mentioned, that great circumspection is necessary in passing near the regions where these dangers may reasonably be expected. The following instances, selected from many others, may operate as sufficient cautions:—

On the 21st of June, 1794, in lat. 45° 18′, on the eastern steep edge of the Grand Bank, in a thick fog, H.M. frigates *Dædalus* and *Ceres* were suddenly involved amidst some very high and dangerous islands of ice. The weather was so thick that objects were not visible at 50 yards distant. The *Dædalus*, commanded by Sir Charles H. Knowles, hauled up and passed close to the stern of a ship that lay stranded upon one of the ice islands, and sailed to windward of it through a great quantity of drift ice, and to leeward of another ice island. The *Ceres*, Captain Thomas Hamilton, passed in the same track, and saw the wreck a quarter of an hour after the *Dædalus*. The course was East, the wind S.W., the sea very high, as the wind blew hard, the night preceding from the southward.

Again, on the 15th of June, 1810, the *Dædalus*, commanded by Captain Inglefield, with a fleet from Jamaica, in lat. 41° 33′, and lon. 51° 17′, to the southward of the Grand Bank, passed two icebergs, and the next day another: providentially, the fog, which had been very dense, cleared up for an hour, and allowed the fleet to clear the dangers. (*For the cases of the Eliza and Jupiter, about the same time,* 1810, *see pages* 240, 241.)

On the 2nd of August, 1813, H.M.S. *Bedford*, 74, then bearing the flag of Vice-Admiral Stirling, accompanied by the *Cyane*, 20, Captain Forrest, and *Fawn*, 18, Captain Fellows, with a fleet of 105 sail from Jamaica, at eight a.m., just as the fog cleared away, fell in with an extensive ridge of ice, having an iceberg at each extremity, and about 1 mile in extent, even with the water, over which the seas broke with considerable violence. Had the fog not cleared up as it did, about thirty ships must have struck upon it, as that number were steering directly for this formidable reef, and were within the extent of its sweep. The thermometer was at this time ranging from 63° to 65°, the lat. 45°, the lon. 44° 30′.

On the 31st of August, 1816, Captain Gooday, in the ship *Jones*, on his passage from St. Petersburg to New York, in lat. 46° 50′, lon. 47° 54′, saw an island of ice, from about 1 mile to 1½ miles long, and from 50 to 70 feet high. When first seen, it appeared like a white cloud.

In January, 1818, the brig *Anne*, of Poole, W. Dayment, master, left the harbour of Greenspond, Newfoundland, in the morning, and in the evening of the same day got among ice; proceeded thus about 40 miles, and at daylight next morning was completely beset, and no opening to be seen, in any direction, from the mast-head. In this state the vessel continued for fifteen days, drifting with the ice about 60 miles S.E. by E.,

or about 4 miles in every twenty-four hours. The ice was now become very heavy, high above the surface, and about 20 large bergs were in sight. With this ice the vessel drove until she was in 44° 37′ N., and about 300 miles to the south-eastward of Cape Race, when, on the 17th of February, she got clear through the only opening that appeared in the horizon from East to S.E., all the rest of the circle forming one compact body of ice, as far as the eye could reach. The vessel had been shut in for *twenty-nine* days, in the last fourteen of which she drifted from lat. 46° 57′ to lat. 44° 37′, about 280 miles, or 20 miles a day, S.E. by E., tremendous gales of wind blowing the whole time from the West to the N.W. In the course of this passage the master declared that he saw more than 100 large islands of the solid blue ice, known to traders by the name of *Greenland Ice.*

On the 17th day of the same month, January, 1818, the brig *Funchal*, of Greenock, sailed from St. John's, Newfoundland. At about 15 miles to the westward of this port she fell in with a field of ice coming down from the northward, about 8 miles in breadth, and extending to the northward beyond the reach of sight. Having cleared this, and proceeded westerly about 250 miles, on the 20th, in lat. 47½°, she encountered a still more extensive field, floating to the westward, in the midst of which was an immense iceberg; she cleared this, though not without difficulty, and brought with her a gale of wind, with snow, sleet, and rain, the whole way to Scotland.

On the 6th of May, 1823, the *Mountstone*, of and from Plymouth, was lost on an ice-berg, on her passage to Newfoundland. The master and crew, with passengers, in all ten persons, took to the boat, without provisions, from which three only of the number were taken by a passing ship, on the 14th of the same month, the remainder having died of hunger!

Our next case is that of the *Ajax*, of Wiscasset, New England, on the passage toward London, March and April, 1826. The following is an extract of a letter from *Wm. S. Shaw*, the commander, to his owners, on the subject. His means of protecting the vessel, under perilous circumstances, are worthy of especial notice.

"On the 12th of March, at four a.m. (sea account), between lat. 42° and 44° North, weather thick and cloudy, with squalls of hail and snow, we ran the brig in between two reefs of ice, jammed together apparently in a solid mass, the sea being much smoother than usual, which did not alarm us; we knew we were far from land or breakers, until we felt the ice alongside of us; as soon as we perceived which, we hove-to until daylight, when we found we were surrounded by a solid body of ice. Around us were 30 ice-bergs about 150 feet high, and nearly the size of Segwine Island. Finding the ice chafed us badly, we got out fenders. As we had run into the ice before the wind, it was impossible to get out the same way. At sunrise discovered a narrow opening to leeward, for which we steered under easy sail, and drove her through. We were now in a bay, about 1½ miles wide, the reefs on either side, and large cakes of ice in contact with us.

"The wind still blowing fresh at N.W., we kept her before it about 3 miles, but could not discover an opening to the southward and westward; tacked, and steered N.E. about 12 miles, it being very difficult to avoid the large cakes of ice that crowded thickly around us.

"Finding there was no opening in this direction, and that the two reefs extended as far as we could see; that there were numerous large islands of ice North of us, and an almost innumerable collection of small ones ahead, we concluded, at 10 a.m., to crowd her through the ice; and having prepared fenders of every kind, such as old junk, spars, cordwood, bales of cotton, and part of one cable, we drifted her into it. We were now in the midst of the ice in a severe gale, accompanied with a thick snow-storm; and had it not been for our precaution, in preparing fenders, the ice must have soon made a hole through us. At mid-day, old Sol deigned to show his brazen face, and laughed at our comical situation. This circumstance enabled us to take an observation, by which we found ourselves in lat. 44° 30′ North, and in lon. 43° West (between the Azores and Newfoundland).

"As our fenders were nearly destroyed, we were compelled to cut up more of our cable, wooden fenders not sinking deep enough for the purpose of defence under water. You may judge of the difficulty of *crowding* the brig through, by our progress, which was but half a mile an hour, under two reefed topsails and foresail, the wind blowing heavily. At one o'clock p.m., we suspended two bales of cotton under our *chains*, that they might

not be carried away by rolling against the cakes of ice which we occasionally met, some of which were 100 feet in circumference, and 6 feet thick.

"At one time we were so completely enclosed, that I got out, with part of the crew, and walked on the ice,—a walk that few mariners have probably enjoyed at that distance from land on the Western Atlantic Ocean. At 8^h in the evening, found the surrounding ice much thinner, and the islands less frequent; handed all sails except the close-reefed main-topsail, which we hove to the mast to keep her from ranging ahead on the islands.

"At daylight, finding ourselves clear from the great body of ice, though not from the islands, we made sail, and steered E.S.E. and E.N.E. for three days, with a good breeze, and under short sail during the night. It was the opinion of all hands, that we sailed *three hundred miles* before we were clear of the large islands of ice!"

In July and August of the same year, 1826, H.M.S. *Ringdove* was on her passage from New York, and fell in with an immense iceberg off the Banks of Newfoundland, drifting to the southward, the magnitude and sudden appearance of which astonished every person on board. For the description of an iceberg seen by Captain J. S. Park, 29th June, 1826, see page 258.

In the month of March, 1828, several vessels arrived at New York, which had fallen in with islands of ice in lat. 43° to 44°, lon. 47° to 49°. This was considered as unusually early in the season for such dangers to be met with. In this season, the brig *Catharine and Hannah*, Captain Lumsden, which afterward arrived at Cork, picked up, on the 4th of May, in lat. 45° 11′, lon. 56° 0′ (near *Banque-reau*), a boat belonging to the *Superb*, of and from Bristol, for Quebec, which ran foul of an iceberg on the 21st of April, that stove her forward. This unfortunate occurrence obliged all hands to take to the pumps, at which they continued, without intermission, for two days and a night, when a schooner hove in sight; and the captain proceeded in the jolly-boat to treat with them to take the crew. While the captain was so engaged, the vessel being quite in a sinking state, the crew left the pumps to get the boats out to leave her. They succeeded in getting out a boat (the one subsequently picked up), and seven men got into her; upon which they unhooked the tackle, slipped from the ship, but could not regain her, and it coming on thick weather, they could not find the schooner; thus the unfortunate men were left without provisions, water, mast, sail, or anything that would enable them to struggle for existence, save and except two oars! In this state they were buffeted about for eleven days, when they were fallen in with by the *Catharine and Hannah*. Of the seven men only two were alive; and one of these survived only twenty-four hours. It is almost superfluous to say, that the only food which they had taken was from the bodies of deceased companions.

Captain Barclay, of the *Brilliant*, for Leith, from Quebec, which he left on the 5th of June, 1829, and narrowly escaped shipwreck, having fallen in with a heavy body of ice, about 20 miles East of the entrance to the Strait of Belle-Isle, in foggy weather. The vessel got clear on the 19th of June, after being three days and nights amongst them, and being obliged to proceed 1½ degrees to the southward.

On the 11th of May, 1833, between the Outer and Grand Banks of Newfoundland, the brig *Lady of the Lake*, John Grant, master, from Belfast, with 230 passengers, in lat. 46° 50′, lon. 47° 10′, fell in with ice, and, while endeavouring to pass between two large pieces, a tongue under water, in the ice, struck the larboard bow, and stove it entirely in. It is not requisite here to repeat an afflicting detail; the consequence was, that the brig soon foundered, and only the captain, with fourteen other persons, were ultimately saved.

The bark *Perthshire*, R. Simpson, from Pictou, Nova Scotia, fell in with a field of ice, in lat. 46° 19′, lon. 46° 40′, on the 8th of June, 1845. It was above thirty miles in extent, and on its North end there was a ship, high and dry on the ice, with the crew on board; but could not render them any assistance.

The following are from Mr. Redfield.—On the 1st day of January, 1844, Captain Burroughs, in the ship *Sully*, met with an iceberg in the Atlantic, in lat. 45°, lon. 48°. This is earlier in the winter than any other case which we have met with. Captain B. states, that he had met with ice near this position on the 1st of February, on a former voyage.

In September, 1822, Captain Couthouy saw an iceberg aground on the eastern edge of the Grand Bank, in lat. 43° 18′, lon. 48° 30′. Sounding 3 miles inside of it, the depth

was found to be 105 fathoms. In the month of August, 1827, the same observer, while crossing the banks, in lat. 46° 30′, lon. 48° W., passed within less than a mile of a large iceberg, which was stranded in between 80 and 90 fathoms water. He was so near as to perceive distinctly large fragments of rocks, and quantities of earthy matter imbedded in the sides of the iceberg; and to see, from the fore-yard, that the water, for at least a mile round it, was full of mud, stirred up from the bottom by the violent rolling and crushing of the mass.

On the 27th April, 1829, Captain Couthouy passed, in lat. 36° 10′ N., lon. 39° W. (probably South of the Gulf Stream), an iceberg, estimated to be a quarter of a mile long, and from 80 to 100 feet high. It was much wasted in its upper portion, which was worn and broken into the most fanciful shapes. In 1831, at daylight of the 17th of August, lat. 36° 20′ N., lon. 67° 45′ W., upon the *southern* edge of the Gulf Stream, he fell in with several small icebergs, in such proximity to each other, as to leave little doubt of their being fragments of a large one, which, weakened by the high temperature of the surrounding water, had fallen asunder during the strong gale which had prevailed from the S.E.—(*Silliman's Journal*, vol. xliii., 1842.)

Ship *St. James*, Meyer, July 12th, 1844, lat. 44°, lon. 47° 12′, passed twelve large icebergs; July 20th, passed twenty-five ditto; and July 21st, passed thirty ditto, lat. 43° 50′, lon. 52° 26′, saw the last of it.

Ship *Formosa*, Crawford, June 18th, 1842, lat. 38° 40′, lon. 47° 20′, saw an iceberg 100 feet high, and 170 feet long.

A very interesting item in our enumeration of icebergs is that of those met with in April, 1851, on which were the wrecks of two ships, which had the appearance of, and from all judgments that can be formed were, the ships of the unfortunate Arctic expedition under Sir John Franklin. The particulars have been so extensively detailed elsewhere, that we shall merely give the original announcement, which will suffice for the present purpose. Much more extended particulars will be found in the public newspapers of April 9th, 1852, and subsequently; the Naut. Mag., May, 1852, p. 265, *et seq.;* and the Parliamentary Paper on the Arctic expedition.

The brig *Renovation*, of Shields, Capt. E. Coward, bound to Quebec, on April 20th, 1851, when near the East edge of the bank, in lat. 45° 30′, wind N.E., fresh breezes, clear weather, as much as they could carry fore-topmast studding-sail, fell in with icebergs, one of which was very large, with field ice attached, on which there were two three-masted ships, having their masts struck and yards down, and all made snug; to all appearance they had passed the winter together on the ice. Took the spying-glass, and carefully examined them to see if there was any one on board, but could see no one, &c. &c. A further statement says they were apparently two full-rigged ships (one about 500 tons, the other 350), on an iceberg high and dry, the larger one on her beam-ends, &c. Singularly enough this statement had been published in the *Limerick Chronicle*, May 28th, 1851, a year previous.

In our minds there cannot be a doubt but that these were the ill-fated ships which had been drifted out of the Wellington Channel and Baffin's Bay; and thus eluded all the elaborate and anxious searches that have been made. The incident is a singular one in the history of Arctic ices.

Lieutenant Evans, the intelligent officer to whom we are indebted for a part of these extracts, says, "There is scarcely a doubt but that most of the vessels from the West Indies and America, that have been missing, perished in the same manner as the *Mountstone*, icebergs having been met with some degrees to the southward of the Banks of Newfoundland in June and July. The commanders of vessels, therefore, who have occasion to pass between the parallels of 35° and 50° N., cannot be too cautious: a look-out man should be placed on the fore-yard during the night, and in foggy or hazy weather, also in the daytime; in addition to these, there should be one on each bow; and during a fog, the foresail should be hauled up, especially in crossing the banks, where icebergs have been met with aground. Careful attention, too, should be paid to the thermometer, as experience has shown that it is an indicator of the vicinity of ice. Captain Franklin observes that the approach to ice would be evidently pointed out in those parts of the Atlantic where the surface is not continually chilled by the passing and melting of ice, as in the Arctic Sea; and he strongly recommends a *strict hourly* attention to the *thermometrical state* of the water at the surface, in all parts where ships are exposed to the dangerous concussion of floating icebergs, as a principal means of security. There

would be very little trouble attending such a point of duty; yet, we believe, there are many masters who would not undergo it, but trust to chance the safety of their vessel, their own lives, and those of their crew and passengers: many have made repeated voyages across the Atlantic without having seen floating ice, and, therefore, become incautious; it is to these we would particularly recommend the perusal of this paper. The following extract fully corroborates Captain Franklin's assertion:—'The morning of the 1st of August (says Captain Lyon) was thick and foggy, with rain; at 10 a.m. we discovered, through the haze, our first piece of ice, a small berg, of about 70 feet; we soon passed this and several others, but saw no *floe* or *brash* ice, although there was every reason to suppose that a *pack* was near, from the sudden smoothness and change of temperature in the water, now at 32°, while the air was at only 34°. Repeated observations of this kind have now brought to a certainty the assertion, that the approach to ice from an open sea may be ascertained by the sudden change of the thermometer; and, acting from past experience, I caused the most active look-out to be kept, on observing it to fall suddenly this morning; yet this change first took place in a very thick fog, and we ran about 10 miles before the ice was seen.'

"Mr. Weddell, an experienced master in the navy, recommends that, with a free side-wind, an iceberg or ice island should be passed on the windward side; as by this mean the loose ice, which always drifts farthest, is avoided."

We may sum up the admonitions which have been given by the following remarks:—

The indications of an iceberg are—1. A natural effulgence, or *ice blink*, which frequently renders them visible at some distance, even in the darkest night. At a short distance this effulgence may appear like a white cloud, extending over, or nearly over the vessel's masts.

2. A considerable decrease in the temperature of the water, as shown by the thermometer, in comparison with the heat of the adjacent sea, and with the air above.

3. The roaring of the sea at the base of a berg, which, excepting in a steamer with its paddles in action, may be heard by an attentive listener, when afar off.

These may be of service to vessels crossing the Atlantic, during the season of these floating dangers, between March or February and July.

SHOALS AND VIGIAS IN GENERAL.

On the shoals and vigias in these parallels, the following remarks were made, in 1828, by Lieutenant Evans:*—

"Between the Great Bank of Newfoundland and the English Channel it was found that whenever we approached toward the *vigias* or dangers laid down in the chart, the water changed from the deep blue of the ocean to *green* (in some instances, of a light pea-green), and this colour was not the effect of any change in the state of the atmosphere, but remained the same under the different alternations of sunshine, cloudy weather, and haze; and it was noticed that the medusæ, polypi, &c., were infinitely more abundant in these spaces of green water than in those of a blue colour; indeed, very few of the larger species of these animals were observed in the latter: they were generally of the small orbicular kind, whereas in the green water they were frequently from 3 to 5 feet in diameter, of an infinite variety of shapes, and of the most brilliant colours."

Many changes of colour in the water may be found where no dangers are known to exist; and of such we consider was that seen by Mr. Cornforth, of the brig *Harbinger*, as shown in the *Nautical Magazine*, December, 1835. Latitude calculated up from noon, 39° 13′, lon. 46° 19′, corroborated by sidereal observations. Weather fine and steady. At 3^h 15′ the temperature of the water was 64°; at 3^h 30′ and at 4^h it had risen to 65½°. From the mast-head no sign of breakers could be discovered on the line between the light blue water and the dark green, either to the South or North, though

* Lieutenant John Evans (*a*). R.N., is the author of an inestimable volume, frequently quoted in the present work, published at Bristol, and entitled, "A Revision and Explanation of Terms, Geographic and Hydrographic, including Nautical Terms connected with the Science, copious Accounts of the Winds, and the Changes which take place in the Atmosphere, &c., illustrated with Plates." The work has been allowed to go out of print, but an abridgment of it has appeared, under the title of "A Catechism of Geographical and Hydrographical Terms, for the Use of Schools," &c.

the changes of colour were as perceptible as black is from white; ship running 7 knots, with studding sails on both sides, but soundings were not taken.

Captain Nockells, in the ship *Brightman*, of London, on his return from Jamaica, in June, 1832, passed through a track between the parallels of 40° and 43°, lon. 55° to 40°, and in all this route (southward and south-eastward of the Grand Bank), found the water uniformly of a *deep green colour.* With this tint of water, he seems to have passed nearly over the track of Lieutenant Sainthill, in 1832, described as the *Beaufort Bank*, in lat. 42° 37′, lon. 41° 45′, and noticed in its proper place hereafter.* This subject is again reverted to under the general head of "Soundings and Discoloured Water," in the present section.

ROCHE BONNE and the BANCS VERTES, in the BAY OF BISCAY.

These are two reefs, lying within a short distance of each other, East of the Isle of Ré. Their position will be found already noticed, in the description of the coasts, &c., p. 315.

THE CHAPELLE ROCK, in lat. 47° 43′, lon. 8° 4′ 30″ W.

In the Analysis of the French Chart of the Atlantic, of 1786, it was remarked that a rock, denominated *La Chapelle*, on the chart of 1766, in lat. 47° 24′, and lon. 7° 12′, was said to have been seen in 1764.†

But, on the 27th of September, 1822, as the sloop *Favorite* was returning from Malaga toward Liverpool, at daylight, the water appeared green, as if on soundings; at 10 a.m. the water seemed greener, also at noon, when the latitude observed was 47° 26′ 1″, and the longitude, by account, from last lunar, 7° 41′.

"28th of September.—If we are on soundings, which the water seems to denote, by still getting greener, we must have been on them in the morning, in about 7° 24′ W. longitude, as the watch on deck noticed the colour of the water, so soon as daylight broke. I came on deck, says Captain Livingston, soon after, and immediately remarked it; and the next watch, on coming on deck, at eight a.m., also immediately remarked it; all of us without its being pointed out, and we have three tolerable navigators (experienced seamen), besides myself, on board. At four p.m., water much discoloured, and a heavy sea. About seven p.m., wind abating, and a very cross sea, and one place, in particular, broke, as if on bottom of no great depth. At 7ʰ 27′, latitude, by meridian of the star Altair, a good observation, 47° 36′ 56″. By 7ʰ 30′, water suddenly quite smooth, as if under the lee of land. At eight, the temperature of the water was decreasing, and fearing, however unlikely, that we were near the coast of France, altered our course to clear all danger. At eight p.m., sounded, and got rocky bottom in 65 fathoms, the arming of the lead bringing up a bit of shell and three small black specks. At 8ʰ 21′, again sounded, in the same depth of water, 65 fathoms, and rocky bottom; but this time the arming had only two small specks, and a very minute one; made sail, and kept away to clear the land. At midnight, sounded; no bottom at 80 fathoms. At six a.m., no appearance of land; hauled up: the daylight increasing, perceive the water is less discoloured; and by noon the water is quite blue again.

"At noon, latitude, by account, 47° 49′ 38″; observed, 47° 49′ 49″. Longitude, by account, from last lunars, 9° 15′ 59″, at noon this day.

"We have really passed over a bank, which may extend, in longitude, from about 7° 24′ to 8° 29′ W. of Greenwich: I am aware, however, that this can be considered as a rough guess only; and, from the thermometer, it seems highly probable that some places on the bank are much shoaler than others. At all events the latitude, in which we got soundings in 65 fathoms, may fairly and surely be taken at about 47° 37′ 12″, being nearly the mean latitude, found by meridian altitudes of ∗ Altair (α Aquila), and the ☾, at mean of the times of the two observations, viz., at 8ʰ 30′, when we could hardly have the line hauled in, after the second soundings. Variation allowed on the previous day's work, about 26½° W.

"The *Chapelle Bank*, as we may call it, will, at any rate, be found in lat. 47° 37′, somewhere between the meridians of 7° 24′ and 8° 29′. I have not calculated back for

* The maritime inquirer may perhaps be gratified by turning to a discussion of this subject, written by an *Advocate for the frequent Use of the Deep-sea Lead*, and given in the *Nautical Magazine* of October, 1833.

† It was seen by Mons. Houel, in a dark night, and showing above water.

its position from the lunar of the 30th, because I am convinced Rennell's Current subsequently gave us westing, equal to all we made, or nearly so, on the edge of Channel soundings. I hope that some person, who has time and good chronometers, will ascertain the true position of the bank, now I have undoubtedly ascertained it to exist."

The French surveyors have since said that the Chapelle Rock, which is traced on several old charts, has long been the object of our ineffectual researches. We have found only, in the situation assigned to this rock, an insulated bottom of small extent, having over not less than 80 fathoms, and on which the sea may break in rough weather, but have little reason for believing that a danger exists hereabout.

On the 30th of July, 1828, favoured by fine weather, we traversed on the parallel of 47° 31′, at the rate of 3 or 4 knots, the horizon very clear, and the sea smooth. We lost bottom with 180 fathoms, in lon. 6° 59′ 30″, at three-quarters past three a.m., and thence continued to sound in all directions, near the spot where the rock was said to exist. We at first obtained ground with the depth of 103 fathoms; but, notwithstanding all our efforts, we gained no less than 80, and this was in lat. 47° 33′ 47″, and lon. 7° 20′ 12″. The position of this sounding may be regarded as very exactly determined by lunar and chronometric observations.

It was remarkable here that, at several miles to the West of this bank, a portion of a lower mast was found, 20 feet long, covered with long seaweeds and shells, which, from a distance, appeared like a rock even with the water. The weather was so favourable that, on an approach, the object was found to be really a piece of floating wood; but had the weather been otherwise, so as to have prevented examination, it might have been supposed to be a *vigia*, or rock, even with the water.

We have now the satisfaction of adding, that the existence of this rock is now confirmed, and the position of it well ascertained. Abstract from the log of the brig *Grace Darling*, of Liverpool, 9th of August, 1842 :—" At 1ʰ 30′ p.m. breakers seen close to the vessel, and a sunken rock observed distinctly and repeatedly above water, in the hollow of the sea, which clashed together and broke much. Supposed the rock might be about 4 feet below the usual sea level. It was witnessed by the whole crew of the vessel, which passed within her own length to windward of it, then going about 7½ knots; supposed it to be the Chapelle Rock, of 1766; its circumference appeared to be about 40 feet; it was of a sandy colour, like freestone, and no weed appeared on it. All on board were much alarmed. Latitude, carried on from a good meridian observation, 47° 43′ N., and longitude, reduced from chronometric observations, at 9ʰ 30′ a.m., and 3ʰ p.m., 8° 4′ 30″ W. The chronometer was No. 2,050, by Mr. Henry Frodsham, from whom her rate had been obtained only nine days before, and its accuracy subsequently confirmed, by excellent distances of sun and moon, on the 27th of August; and again, by making Deseada on the 5th of September. So the existence of the rock in the assigned position may be relied on.—*James Tasker*, master of the *Grace Darling*."—*Nautical Magazine*, 1843, p. 48.

DEVIL'S ROCKS, in lat. 46° 35′, lon. 13° 7′.

M. Bellin, in his *Memoir*, of 1742, noticed, that in lat. 46° 55′, about 110 leagues W.S.W. of Ushant, there is a rock, even with the surface of the water, discovered by Captain Brignon, of the *Constance*, of St. Malo, in 1737. The *Devil's Rocks*, in lat. 46° 35′, and lon. 13° 10′, according to M. Delisle, may be the same danger. These have been marked on many charts. They were particularly observed in 1764, by Captain Thomas, a respectable and intelligent navigator of Havre de Grace, from whose written communication, addressed to M. L'Abbé Diquemare, we find that, on the 23rd of May, 1764, Captain Thomas observed, at noon, the lat. 46° 24′. The danger was discovered at the same moment, off the larboard bow, at a short distance, 3 feet above water, of a gray colour, covered with moss, and about 40 feet in diameter. We formerly placed it, upon this authority, in lat. 46° 24′, estimating the longitude at about 13° 10′.

In a *Liverpool Advertiser* of the 5th of July, 1819, a note on these rocks was given as follows:—" The *Brothock*, of Arbroath, Captain William Peter, on a voyage from this port to Rio Janeiro, on the 13th of November [1818], running with a fresh breeze from the N.N.E., at noon observed a rock about 10 feet from the starboard quarter, about 2 feet under the surface of the water, in lat. 46° 35′ N., and the longitude, by mean of two well-regulated chronometers, 13° 7′ W. The sea recoiled around it, and broke on the top. Its circumference appeared to be about 40 feet. The above rock agrees in

latitude with the Devil's Rocks, which have been so long doubtful: its longitude differs a few miles only."

This rock was seen a few years ago by Captain Scott, of the cutter *Voast;* and again, at four p.m., on the 25th of April, 1829, by Captain Henderson, of the *Fortescue*, from Mauritius to London. The appearance, according to the latter, was that of a rock, of a brown colour, about 12 feet long, nearly as much in breadth, and about 2 feet above water. The latitude (at four p.m.), carried on from meridian altitude that day, was 46° 33′, and mean longitude, lunar and chronometric, from observations in the morning, 13° 2′ W. Captain Scott is of opinion that there are more heads of rocks than one; that which he saw was like the point of a sugar-loaf.

The Devil's Rocks were seen, in 1829, by Captain Swainson, in the *Fortitude*, of Dublin, and described as in lat. 46° 35′, lon. 13° 8′. They were subsequently sought for and seen by a commander, who has said, that the water was seen breaking upon them very high, and as it receded the rocks were discernible:—"We were going 9 knots at the time, and had the wind not been very strong, I do not think they would have been observed. In fine weather I am of opinion the water would not break upon them. I did not heave-to, when I neared them, to take an observation, but made one soon after, and, from the distance we had run, I made them to lie in nearly the same position as that of the *Fortitude*."

Lieutenant Sprigg, commanding H.M.S. *Brisk*, says:—"On the 6th of August, 1842, we were distant from the Devil's Rock, at noon, 35 miles, and doubting its existence, I shaped a course directly for it. At seven p.m., whilst looking over the taffrail, my attention was suddenly attracted by a change in the colour of the water under the ship's counter, which had been of a blackish green. On looking over the starboard quarter, the change to whitish green was more vivid, extending in a N.N.W. and S.S.E. direction for 1¼ miles, its greatest width close to our wake, about three-quarters of a mile, having very irregular and indented sides, in bold outline with the dark water surrounding it. A heavy swell from N.W. seemed smoother over the patch, without any visible break; but that it was a shoal no doubt exists on my mind, or on many that saw it. The mast-head man, unfortunately, did not report it, though he admits having seen it 3 miles before reaching it, and about the same time before he lost sight of it astern. From the deck, in about fifteen minutes, it disappeared, preserving its shape and colour to the last.

"The sun was 6° or 8° high at the time, the vessel going 8 knots, and as we had no more than four days' provisions, on reduced allowance, I did not feel justified to return and sound, nor would I have attempted to pass over it in the brig. Its situation, by our dead reckoning, from afternoon sights by the sea and the planet Jupiter, places the spot in lat. 46° 12′ N., lon. 15° 3′ 30″ W."—*Nautical Magazine*, 1842, p. 793.

On passing this way in the *Friends*, 17th of August, 1820, Captain Livingston says:—"At about 2ʰ 20′ p.m., supposed to be certainly to the southward of the *Devil's Rocks*, and looking over the lee-quarter, I saw what, at first sight, appeared to be a bottle, about 30 fathoms to leeward. The sea immediately covered it, and on its emerging again, it seemed like the back fin of a shark, in the wash of the sea, about 4 inches above water, and of a triangular form. I sang out, 'A shark, and a large one, too.' To my surprise, it did not seem inclined to follow us in the wake, and we passed it quickly. A few moments afterwards, as I was attempting to point out the place I had seen it in to the mate, he remarked that he saw breakers off the boom-end; and, on paying attention to it, I plainly saw a slight curl and break of the water for fully half a mile; but as the water was very smooth, the break was not great, though still plain enough, while no part of the surrounding sea broke. Some time afterward, when the rise of the thermometer in water led us to reason on its cause, and reconsider the circumstances, the result was an impression, that we had passed a large and very dangerous shoal, situated in about 46° 9′ 30″ N., and 12° 50′ W."*

* In the *United Service Journal*, October, 1834, p. 190, is a lively description of a moonlight night at sea, during a gale, which concludes with that of a dreadful reef, supposed to be the *Devil's Rocks*. The communication is more in the style of a novelist than of a seaman, and there is not a word on the *situation* of the reef. The following are extracts:—"The time about 11 p.m. In a moment the cry of *breakers* went through the ship; and so sudden, so unexpected, was the danger of destruction, that hope of safety there was none: the ship was flying through the water; the breakers not more than 2 cables' length off; not only ahead, but several points on each bow.

"The black tops of a reef of rocks were seen, occasionally bared by the reflux of the boiling

MAYDA, 1705.—CLARK'S ROCK, 1842, lat. 45° 40′, lon. 19° 17′ W.?

We have in this a danger which had been settled as not existing, but two recent communications seem to show that it is a reality. The following are the notices of it, the discrepancies in which we cannot attempt to reconcile, although they seem to relate to the same spot. MAYDA.—This vigia appears, on the French chart of 1766, in lat. 46° 48′, and lon. 19° 50′. The latitude, according to Bellin, is uncertain, and its longitude more so. A report, made to the Admiralty of Bordeaux by Pierre Nau, in October, 1705, states it to be a *little white island.* There is a note concerning it in the French depôt, but it disagrees with the report of Pierre Nau. Captain Biden, in the ship *Marie*, when returning from Martinique, April 10th, 1738, having had a good altitude in fine weather, discovered Mayda, which, according to his observation, he found in lat. 46° 10′. He remarked *five heads of rocks*, and a breaker of 6 or 7 feet high on the danger.

This is the original information on this spot, which, perhaps, would almost identify it with the Five Heads, stated to be to the southward. But it has been again revived by the following communication:—"On board the bark *Hartley*, W. B. Bradford, master, bound from Sierra Leone to Plymouth, passed, on Friday, 26th August, 1842, at half-past 5 o'clock, p.m., in lat. 45° 40′, lon. 19° 17′ W., at the distance of three-fourths of a mile from the ship, a *double-headed rock*, which, during the fall of the sea, was uncovered to the height of 6 or 8 feet. The sea broke over it with a gentle spray, and during the rising and falling of the water it was observed to be of a *dirty white colour*, interspersed with dark coloured patches. At the time it was noticed the ship was sailing at the rate of 4 knots an hour, with the wind from the North. The stormy petrel and other birds were flying about it. It was first seen by one of the crew, and was supposed to be the carcase of a whale; to me, however, it was evidently a rock, in which opinion Captain Bradford, on perusing the chart, coincided. It is to be regretted, the weather being fine, that an examination was not instituted, which could have been easily accomplished at the time, but which was declined, as occasioning delay. Later in the evening the weather became squally. It is well to remark that its position was ascertained by chronometer.—*Robert Clark*, Senior Assistant-Surgeon to the Colony of Sierra Leone."—*Nautical Magazine*, 1842, p. 852.

This might, possibly, have been the carcase of a whale, but it coincides with former accounts, and is, in some measure, confirmed by the following:—"When going out to the West Indies in 1840, in lat. 46° 36′ N., lon. 19° 30′ W., I saw a rock within 100 yards, of a conical shape; it appeared about 4 feet out of water, in the trough of the sea. I should think it would be under water in a smooth sea.

"You will see, by the chart, between these two places (the foregoing, and Clark's Rock) a vigia, marked as doubtful, called 'Mayda;' so it appears very evident that there is a rock about there.—*D. England*."—*Nautical Magazine*, 1843, p. 132.

THE FIVE HEADS, in lat. 44° 15′, lon, 19° 25′?

Under this denomination the French chart of 1766 has a rocky shoal some part above water, in lat. 44° 10′, and lon. 19° 25′. It is marked some minutes more to the North on the charts of M. Van Keulen. No account of it is, however, given either by him or Bellin;

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surf. The ship was in the midst of breakers. Two mighty surges rushed over her deck, and swept away everything loose into the sea. The reefs, among which she was entangled, appeared to inclose her like a horseshoe, forming a barrier of foaming surf ahead, and for several points abaft the beam on either side; but, by aid of the powerful moonlight, the captain espied a small spot of dark water to larboard, forming a gap in the line of breakers. We neared the spot fast: it widened as we advanced, and the ship, by excellent seamanship, shot through a channel scarcely half a cable's length in breadth, and between two walls of gigantic breakers.

"The reef seemed to extend from N.W. to S.E. in a semicircular direction; its convex side turned to the East, and presenting, for apparently a distance of 3 or 4 miles, a line of tumbling and whitened foam.

"The sails being now trimmed, the ship was once more put before the wind, and bounded buoyantly on. The white heads of the breakers grew less and less apparent, and seen only at intervals, whilst the sound of their thundering rush was lost in the hollow moaning of the wind." See, farther, Captain Livingston's communication upon this subject, *Nautical Magazine*, December, 1834, p. 737.

nor, although sought after, has any account of it yet been found. It seems that Bellin, in his charts of 1757 and 1766, has given it on the solitary authority of Van Keulen. We shall erase it from the charts.

ISLE VERTE, or GREEN ROCK, in about lat. 44° 52′ N., and lon. 26° 25′ W.

This rock, the *Green Island* of the old charts, has been omitted in others, on the authority of Messrs. Verdun and Borda, who have said, "On M. Bellin's chart of 1766, in lat. 44° 52′, and lon. 26° 25′,* is an *imaginary* island, named the Isle Verte, or Green Island. In the Memoir of 1742 we find nothing concerning this island, but that the 'Isle Verte is marked according to *Le Boccage.*' It appears on the English chart of Jeffery's, in lat. 44° 45′, and lon. 26° 10′, and is supported by no better authority; we cannot, therefore, believe that it exists. A great number of ships pass every year through this latitude and the adjacent parallels, and a thousand authorities would surely attest its existence, were it not *imaginary.*"

Notwithstanding all this, Captain Tulloch, of New Hampshire, has stated, that an acquaintance of his, Captain Coombs, of the ship *Pallas*, of Bath, in the district of Maine, when crossing, or running down, the parallel in which Green Island is laid down in the charts, and keeping a look-out for it, although he had little idea that it really existed, actually saw it, being on a very fine day, and the water remarkably smooth: he went out in his boat, examined it, and found it to be a large rock or stone, covered with green herbage, or moss, *some of which he pulled off.* The rock did not seem much larger than a vessel with the bottom up, and it was very smooth around. The summit was higher than a vessel's bottom would appear out of the water, being about 20 feet high above the sea. Captain Coombs remarked that, if it had not been so high, he should, when he first saw it, have supposed it to be a vessel which had been upset.

Captain Tulloch considers that Captain Coombs, who is now dead, was a man of perfect veracity. It is to be regretted that we have not yet the exact position of the rock.

(*Communicated by Captain Livingston,* 1819.)

GREEVE'S LEDGE, in lat. 44° 15′, lon. 25° 5′.

This is stated to have been seen by the Dutch ship *Anna Catharine*, Captain J. Greeve, July 7, 1745, and to be nearly level with the sea. It is said to have been seen by Captain Currie, of the brig *Diana*, of Port Glasgow, 1811. Captain Livingston says,—"I was informed by one of his crew (John Hagarty, whose veracity I can depend on) that they saw it very plainly. It was a rock, about 2 feet above water, and had sea-weed growing on it. On being asked if it might not be ice? he replied, 'he was perfectly certain that it was not.'" *The position is yet uncertain.*

MIDGLEY SHOAL, in lat. 44° 9′ 30″, lon. 22° 57′ 45″.

This shoal was discovered by Captain Thomas Midgley, in 1838, who describes it as follows:—"On the 14th of June, 1838, at 2^h 40′ p.m., on my passage from Africa to Liverpool, I suddenly fell in with a large patch or belt of discoloured water, of a dirty gray appearance, much resembling river water, and *rippling very much*, as if upon a shoal bank. No rock nor danger could be seen from the mast-head, but the water appeared very much discoloured for more than half a mile in breadth, as far as the eye could reach, in a direction N.W. and S.E. by compass.

"The vessel passed at a quarter to half a mile from the S.E. point or extremity of it, which lies in lat. 44° 9′ 30″ N., lon., by an excellent chronometer, 22° 57′ 45″ W. of Greenwich, and by account from Flores, 23° 5′ W.; the latitude deduced from the sun's meridian altitude, taken on the same day, with two excellent sextants, and the chronometer ascertained to be correct off Flores four days previously, and subsequently when off Holyhead in St. George's Channel. The altitudes for the time were taken a few minutes after passing the danger, and when it was still within 1 mile from the vessel.

"In appearance this water very much reminded me of the shoal ground near Nantucket, and those on George's Bank; had it been caused by ice, some would have been

* Originally 28° 45′, or from Paris.—ED.

seen upon the surface; if by fish, there would have doubtless been many birds hovering about, which was not the case.

"At the time I saw this danger, I was running with a favourable breeze and clear weather, and the contrast between the deep blue colour of the water, in which the vessel was sailing, and that of the danger I allude to, was noticed by every one on board.

"This is perhaps the *Greeve's Ledge* of the charts, said to have been seen by Captain Greeve, of the Dutch ship *Anna Catharine*, in 1754, and since by Captain Currie of the *Diana*, of Port Glasgow, and laid down in lat. 44° 15′ N., lon. 25° 5′ W., the latter probably by dead reckoning.

("I sincerely regret my inability of closely examining the shoal, owing to my crew being on short allowance of provisions and water, in consequence of a long prevalence of light and adverse winds.")

WOODALL'S ROCK, near lat. 43° 20′, lon. 25° 10′.

"Ship *Indemnity*, at sea, on her way from Demerary to England, 1829, at 30′ p.m., discovered a rock on her starboard beam, distant about three ships' length; the ship was then going at the rate of about 2½ miles an hour, with a heavy swell from the N.W. With each succeeding swell the rock was entirely covered, but at intervals it showed several feet above water, and perfectly perpendicular. From the mast-head it was seen to a great depth below the water, and appeared to be in the shape of a cone. At the preceding noon the latitude, by observation, was 43° 20′ N., longitude, by chronometer, 25° 10′ W."—(*Attested by the captain, mate, and passengers.*)*

AMPLIMONT ROCKS, in lat. 42° 51′, lon. 24° 15′.

In M. Bellin's Memoir, of 1742, a danger is mentioned in lat. 42° 30′, lon. 24° 5′, which was seen in 1735 by M. Guichardi, commander of the ship *Dauphin*, of Nantes. It has two points of rocks, separated, and 30 feet above water. He ascertained the height within a league of the danger, which appears to be the same as that called *La Basse d'Amplimont*, stated to be nearly in the same latitude and longitude. We have given it the position originally assigned by the Memoir. Some Englishman has called it by the name of *Edmund Knowles's Rock*, by whom it is supposed to have been seen.

These rocks, appearing like the two masts of a brig, and nearly in the position assigned, were seen by Captain Mills, in the brig *Tamer*, early in 1829.

The existence of this shoal is entirely set at rest by the following communication, forwarded to us by Mr. T. Reed, of Sunderland:—

"On the 13th of May, 1842, I sailed from Paimbœuf for Quebec, with the wind at N.E. We had a fine run to lon. 19° 44′ W. On the 23rd of May (at noon, in lat. 42° 31′ N., by two good observations, and lon. 24° 3′ W.), at 7h 20′ p.m., I passed a rock within 2 ships' length. When I first saw it, it was a little before the larboard beam, and appeared like a ship's anchor-buoy. When it came upon the quarter, I saw the sea-weed quite plain upon it, as did also the watch on deck. Another part of the rock we saw under water, about 8 or 10 feet from the rock we saw above water; at intervals it was covered and uncovered. We had not much swell on at the time, fine pleasant weather. At the time of passing the rock, the ship was in lat. 42° 51′ N., lon. 24° 15′ W. The rock was seen a considerable time after we passed it. Wind at the time W.N.W. Ship's head, North, going 3 and 3½ knots per hour."—*Captain Thomas Alderson, of the Morning Star.*

* In Captain M. White's, R.N., "Remarks on the Winds, Tides, &c.," p. 6, he says, "There can be hardly a doubt but that the Five Heads, together with the Isle Verte, Greeve's Ledge, Midgley Shoal, and Woodall's Rock (the first three of which are said to have been seen *above* the surface) will be found to constitute one and the same danger *beneath* it." The only position which can be depended on is that of the Midgley Shoal; and it is possible that the asserted situations may be as much in error as they differ from that. The evidence of a rock, or rocks, having been seen *above* water appears to be substantial, and we must not, therefore, too hastily deny the existence of such dangers. A single and solitary head, even with, or just beneath, the surface, may very easily escape notice, considering the time of tide, the state of the sea, darkness, and many other contingencies, which may occur at the time a vessel may be passing it. It would have been deemed impossible that some rocks should exist in well-frequented situations, without having been discovered; and yet such is not an unusual occurrence: for example, the Dædalus Rock, off Cape St. Vincent, and many others. From these considerations we have retained the above statements for future examination.

It was also seen by *Captain L. W. Duff*, of the *Esperance*, on his voyage from Valparaiso to Swansea, on Nov. 19th, 1846. He was looking out for the Amplimont Rocks, scarcely expecting to meet with them, when he was startled by a large and dangerous rock, with two pointed summits in the hollow of the sea, not ten yards off on the larboard beam. He could see no more of it after passing, nor the sea breaking on it, which it would do in bad weather. He had the day before passed Corvo, and found his chronometer accurate, and also the same on making Lundy Island. His position of it is lat. 42° 56′ N., lon. 24° 30′ W. We have given the mean of this and that by Captain Alderson as the true position.

Respecting the discrepancy of the height of 30 feet, and even with the water, as the accounts state this rock, it must be remembered that a century of wear from the waves had elapsed, and might possibly render the rock still more dangerous from placing it farther beneath the surface.

Henderson Bank, lat. 42° 45′ N., lon. 29° 0′ W.

The existence of an extensive elevation of the bed of the ocean in this vicinity would seem to be constantly receiving some fresh accessions of evidence. The numerous peaks or summits of this tract that have hitherto been discovered, as previously related, may be all more or less connected by intermediate comparatively shoal water, being thus like a submerged archipelago, the volcanic character of those in the vicinity, the Azores, Madeiras, and Canaries, rendering such a supposition probable. Now that the practice of deep sea sounding is being frequently resorted to, we may expect that additional information on this interesting subject will soon be recorded.

We have evidence that at least some portion of the bottom to the northward of the Azores is within reach of the ordinary sounding lead. The ship *Chaucer*, Captain Robert Henderson, from the Mauritius to Glasgow, states that, on October 23rd, 1850, he made Fayal, and found the rate of his chronometer unaltered since leaving St. Helena.

"On October 28th, at noon, we were in lat. 42° 41′ N., lon. 28° 45′ W., steering N.W. by W. (*true*), with light variable winds from the eastward, and fine clear weather. Having previously observed that the water had changed colour about 10 a.m., and since that there was a sensible ripple, at 2 p.m. I sounded, and found hard bottom at 48 fathoms; the distance run since noon about 6 miles.

"At 4 p.m., having steered the same course, in lat. 42° 49′ N., lon. 29° 4′, sounded and found 50 fathoms, and at 6 p.m., having run about 6 miles, found 70 fathoms, rocky bottom.

"From observing the change of colour and ripple at the surface of the water, at 10 a.m., and having sailed from that time up to 6 p.m. nearly N.W., the bank may probably extend considerably to the S.E. of the position where I took my first sounding at 2 p.m." —(Shipping Gazette, November 10th, 1850; Nautical Magazine, 1851, p. 103.)

It by no means follows that the whole extent of the bank was crossed or seen in this track, and it is possible, nay, probable, that less depth than 48 fathoms may exist on it, and may hereafter be found.

The Three Chimneys, in lat. 47° 54′, lon. 29° 40′.

This vigia is said to have been seen on the 10th July, 1729, by Captain de Clas Fernel, who approached within 2 leagues of it, and who remained two hours in sight of it. This vigia appears to be one which a M. de Merry has mentioned. The charts vary with regard to its position.

Thus much we have stated in our former editions; but Mr. Heron, of Greenock, in 1824, adds, "I am informed by the master of a merchant-vessel, that the Chimneys actually exist; for a whole watch, as well as himself, saw them. They were seen about twilight, and three heads were distinguished. From an observation taken at the preceding noon it was inferred that their latitude, as laid down on the chart, is very near the truth."

The following confirms their existence. Captain Roallons, in the brig *Eagle*, passed a rock above water, at the distance of about 4 miles, on the outward passage from Hamburgh to Newfoundland, on July 29th, 1842.

"By a good observation at 8^h 21′ 14″ a.m., the longitude 28° 32′, latitude, by meridian altitude, 47° 41′ 22″, the vessel then making a true West course, and running, by log, 5 miles an hour until 11^h; when abreast of it, bearing S.S.W. by compass, leaving it in

lat. 47° 37′ 22″, lon. 28° 51′, it formed *three distinct points;* the highest to the westward appeared to be about 80 feet high, the sea breaking violently over the lower part, near the eastern extremity, but no appearance of shoal water around it. Was in sight of it about two hours, and should have gone nearer, but was prevented by the wind setting to the southward: it was seen distinctly by the mate and crew."—(*Times*, 16th December, 1842.)

GOUGH'S ROCKS, in lat. 40° 28′, lon. 30° 0′.

These rocks appeared in the chart of M. Rochette, 1778, with the words, "Rocks seen by Captains Gough and Birch." Vankeulen and Bellin have indicated several dangers in the vicinity to the N.E., but their existence has been denied by the pilots of the Azores.

Captain Livingston says, "Captain Beauford, of the brig *Concord*, of North Yarmouth, told me at Malaga, in 1820, that he twice saw Gough and Birch's Rocks, when bound from Newfoundland to Lisbon; that one of them is about 12, and the other 3, feet above water; and that they lie nearly in the longitude originally assigned them in the charts, but 5′ more to the northward."

Another report states, that Gough's Rocks were seen by Captain Harrison, in the brig *Hope*, from Sierra Leone to Cork, 17th April, 1830, lat. 40° 16′, lon. 33°. At 11 a.m. two rocks appeared close under the lee-quarter. In smooth water these rocks would be even with the water's edge, and in the hollow of the sea Captain Harrison could distinctly see six or eight down in the water.

BEAZLEY SHOAL, in about lat. 40° 45′ N., lon. 36° 47′ W.

In the chart of the Atlantic Ocean, drawn up by M. Rochette, and published by him in 1778, there is a shoal of 5 fathoms, stated to have been seen in 1769 by a Spanish ship in lat. 40° 26′, lon. 36° 5′. It is possible that this may be the same as the rocks seen by Captains Gough and Birch, last described, but the following statement, to which attention was drawn at the time, in 1841, but was singularly neglected, will place it again in a more certain light.

"Captain E. W. Beazley, then commanding the bark *Castries*, from the West Indies to London, on Sunday, June 20th, 1841, at 6h 20′ p.m., passed a shoal half a cable's length to the northward of the ship; it appeared about the size of a large ship's quarter deck, with the sea-weed almost awash with the water's edge; the sea rolled over it, but *did not break;* it is to be regretted that the weather would not allow the ship to be brought to, to examine this startling danger. The latitude and longitude, brought on by dead reckoning, from noon of the 19th, places this dangerous rock in lat. 40° 45′ N., lon. 36° 47′ W."—(Nautical Magazine, 1851, p. 331.)

This statement, which certainly does not appear to be lightly made, is deserving of more attention than has been given to it, though it is possible that the suggestion as to its being a floating *wreck* may be correct.

JAQUET ISLAND, in lat. 46° 55′, lon. 39° 30′?

The existence of this island has been so much doubted, that it has been omitted in several modern charts; but, having been stated to have been seen in 1789, it has been restored.

A letter from Jersey, 3rd of April, 1838, states that *Jaquet Isle*, in about 46° 55′ N., lon. 39° 29′ W., was seen by the brig *Sea-flower*, of Jersey, at 5 a.m., on the 25th of April, 1836: the weather fine and clear. On seeing the isle the vessel hove-to and sounded; but no bottom was found at 100 fathoms. The isle appeared to be half a mile in length, and about 300 feet, or 100 yards, high above the surface of the sea. Rocks may be seen extending a cable's length from the S.S.E. end, which appears to be the highest land, with a vast number of birds, such as are seen on the Banks of Newfoundland. By the ship's course and distance run from 6 a.m. to noon, the isle is estimated to lie in the position above expressed.

Mr. Le Gros, mate of the *Sea-flower*, who sketched the appearance of the isle when it bore between E.N.E. ¾ E. and ¼ S. (by compass), declares that it is *not* an iceberg, as commonly supposed. Latitude, at noon, 46° 50′; course, after 6 a.m. to noon, W.N.W. [*W. ¼ S., true*] 48 miles. Ship's longitude at noon, by reckoning, having no chronometer, about 40° 41′ W. Here may be added that doubts, previously entertained, have not entirely vanished.

BEAUFORT BANK, lat. 42° 37′, lon. 41° 45′.

Lieutenant A. Sainthill, R.N., commander of the ship *Beaufort*, on returning from Jamaica, August 3, 1832, when in lat. 42° 37′, lon. 41° 45′, observed the water to be discoloured; in consequence of which he twice tried for soundings, and found rocky ground at the depth of 100 fathoms. Lieutenant Sainthill is of opinion that soundings might be found from the meridian of 20° West to the Banks of Newfoundland. See, upon this subject, the *Nautical Magazine*, October, 1832, page 393, and October, 1833, page 599.

DRUID'S REEF, in lat. 41° 19′, lon. 41° 25′.

On the 12th of April, 1831, Captain Treadwell, in the *Druid*, of London, passed this reef on his starboard hand, at not more than 30 yards distant. The weather was calm, and he had taken a good meridian altitude, whence the latitude was assumed as above, with the longitude by a chronometer which has always proved correct. The reef had the appearance of from seven to ten sugar-loaf heads, and its length, from E.N.E. to W.S.W. was estimated at 10 to 14 feet. It was about 3 feet above water.

The reef was heretofore inserted from the late Spanish chart, as seen in 1803, lat. 41° 24′, lon. 41° 20′; but we are not acquainted with the authority under which it has been there introduced. It may possibly be a rock, said to be seen by Desmaires, a pilot, in 1683, who reported that it appeared at the height of a sloop above the water. Bellin assigned to this danger lat. 42° 0′, lon. 41° 10′. The Spanish chart also exhibits another *vigia*, said to have been seen in 1798, lat. 43° 30′, lon. 37° 35′. Most likely to be of ice only.

HERVAGAULT'S BREAKERS, in lat. 41° 2′, lon. 49° 23′.

We have shown the situation of these breakers on the Chart, although it has been the opinion of many experienced navigators that no danger exists here; and that masses of ice, seen in these places, have been mistaken for rocks. They were inserted originally upon the authority of M. Hervagault, commander of *Le Conquerant*, of Nantes, 26th of June, 1723, who described them as composed of two parts, between which he was forced to pass; being, when he first perceived them, at a cable's length from the one, and not more than an eighth of a league from the other. The sea between was very clear, and broke heavily upon the dangers. In a manuscript at the French Depôt Marine there are these additional particulars:—"The shoal, within a cable's length of which he passed, is a rock, which showed itself after the sea had broken upon it. On the other danger, the sea broke in three different places, and between each it appeared very clear."

Again, on the 12th of May, 1827, Captain Maxwell, of the ship *Home*, on his passage from Liverpool to New York, fell in with three sunken rocks, with a tremendous sea breaking on them, apparently from 4 to 6 feet under the surface, in lat. 41° 2′ North, lon. 49° 23′ West, and about 30 feet in circumference; the last of them tailed off to the north-eastward with a long ledge. Captain Maxwell says, "I would have sounded immediately, but being just dusk, and the ship under a press of canvas, prevented me. The air at the time was 63°, and one hour before we perceived the danger I tried the thermometer at the depth of 2 fathoms, and found it to be 45°; an hour afterwards, I tried again, and found it 60°. The above information I have conceived it my duty to give you, being aware that many of my seafaring brothers must have suffered on this fatal spot, although from the first of these rocks to the last was within 1 mile. Winds, at the time, W.S.W.; ship's head, N.W., going 7½ knots per hour. The chronometer I have with me can be depended upon to 1 mile, and the latitude and longitude I have given is correct." This shoal is the Hervagault's Breakers of the French charts. In 1816 it was seen by Captain Lourp, of the brig *Alexander Savage*, who places it in lat. 41° 6′ 23″ N., and lon., by dead reckoning, 49° 57′. We, of course, adopt the situation assigned by Captain Maxwell.

DARAITH'S ROCKS, in lat. 40° 50′, lon. 54° 53′.

The same opinion has been entertained of this as of Hervagault's Breakers. M. Bellin, however, placed it as a certain danger; and in his Memoir, of 1742, has said that this danger was seen on the 22nd of August, 1700, by M. Daraith, who approached within 1½ leagues of it, then sailed round it, in order to observe it well, and took an altitude within sight of it. The rock is described as extending 1½ leagues, being three-quarters of a league broad. Its longitude is very uncertain.

WATSON'S ROCK, lat. 40° 18, lon. 53° 40'?

Extract of a letter from Captain T. A. Watson, of the *Harbinger*, dated Liverpool, 22nd of July, 1824.

"Perhaps you may have seen, in some of the newspapers, a notice respecting a rock seen by me in April last, on my passage from this port (Liverpool) to St. John's, N.B. The following are the particulars:—April 28th, at eight a.m., being on the starboard tack, ship going 2¼ knots an hour, moderate weather, a man saw something ahead; the helm was immediately ordered a-weather to clear it: being very near it, ship was only 15 or 20 fathoms to leeward of it, which enabled me to distinctly make it out to be a rock, just even with the water; its head was round, and appeared to be about 3 fathoms or more in diameter; it was covered with weed, similar to that on half-tide rocks; it was of a light green, with some branches of a red colour. It was at times, on the top of a sea, invisible; but in the hollow of a sea, several feet uncovered. I observed the sea to break on it twice, causing a spray, as any pinnacle-like substance, with deep water around it, might be expected to do. My first officer and others also saw it, and are fully convinced of its being a danger; the lead was hove as soon as it could be got forward, but there was no bottom at 80 fathoms perpendicular. I might then be within musket-shot of it; from the mast-head no appearance of other danger could be seen.

"From an excellent observation at noon, I consider it to lie in lat. 40° 18' N., lon., by dead reckoning, 53° 40' W.

"The water for several miles around it was dark, as if on soundings. Fearing I might strike on some invisible danger, I did not put the ship's head toward it, and there was too much sea to lower a boat; recovering from the consternation this unexpected sight put me into, I left it astern, fearing there might be more beneath the surface, directly in the track I was going.

"From my thermometrical observations on approaching to and on the Great Bank of Newfoundland, I have reason to think the above longitude nearly correct; at least, if any error, it could be only a few miles too far eastward. I unfortunately broke this most *valuable* instrument a short time before seeing the above danger.

"I understand there have been many opinions as to the truth of my statement; it is difficult to convince some; and perhaps if the *Harbinger*, which I commanded, had struck on it, some would have supposed she had alighted on the back of a whale, though, by-the-bye, weeds are seldom seen growing there.

"During the many years (14) I have commanded a ship, mostly in the North American trade, I have seen various things in the ocean, and was too well acquainted to mistrust my eyes in this case. It is said that Daraith saw a danger not far from this; perhaps it may be a part of the same, as he represented it as very extensive. I am convinced we too often treat *doubtful dangers*, in charts, with indifference, because they are not always seen by those who look for them; may it not be the case that ships sometimes are wrecked on them, and never heard of? However, I shall always dread the above danger when sailing in that part of the ocean."

The foregoing certainly appears circumstantial; and it therefore behoves every commander to use the utmost caution in this neighbourhood, and also use all means to set the question of the existence of these rocks at rest.

But this locality possesses some peculiarities. In some seasons the verge of the Gulf Stream will be hereabout; or, at least, its warm current will be intersected by veins of colder water, and give rise to apparent anomalies. To this also may be added, that hereabout the floating icebergs may be brought down to low latitudes, over the Banks of Newfoundland, and into the Gulf Stream, by the deeper seated southerly polar current, as explained elsewhere. On this view, the ensuing remarks may be explained by these causes:—

The first is one of temperature. The *John Garrow*, Hamilton, just arrived at Liverpool, passed over a bank about 15 miles from West to East, lat. 40° 25' N., lon. 54° 28'. The sea ran higher on than off the bank, the water was very much discoloured, and large quantities of sea-weed were floating about. Tried the temperature of the water, and found it 12° below the air, and when the bank was passed over found the water 14° above the air. A very heavy gale blowing at the time. The *John Garrow* was prevented sounding. (*Shipping Gazette*, February 4th, 1851.) It has been shown in another place that temperature *alone* is not a sufficient indication of the presence of shoal water.

The next is a similar one. Captain James Akett, of the ship *Corsair*, from New Orleans to Liverpool, on February 19th, 1849, found the temperature of the water, at eight a.m., was 66°; at ten a.m., 63°; at noon, down to 60°; at one p.m., 61°; at two p.m., 63°; and at four p.m., 66°. Lat. obs., 40° 5′, lon. obs., 53° 45′. Noon, squally weather, with a very heavy sea running; could not see more than 4 or 5 miles from the ship; no dangers in sight; still I think there is a bank or rock not far from my situation at noon; may it not be Watson's Rock, which is treated as doubtful?—*Nautical Magazine*, April, 1849, p. 217.

Now the season of the year, in both these instances, precludes the notion of floating ice occasioning the fall in temperature. If, therefore, it cannot be attributed to the ship's being on the South edge of the Gulf Stream, or in a vein of cold water within it, there may be some ground for believing in the presence of a rock. This must be left for future decision.

The next is of a different character. Marco Carmelich, commanding the Sicilian brig *Anna*, at three p.m., June 8th, 1841, observed a shoal to the South, distance about 2 miles, appearing like a ship with three masts of equal height, and inclining toward the South, and about 50 feet high, surrounded by shoals level with the water; lat. 39° 32′ N., lon. 50° 50′ W.—(*Nautical Magazine*, November, 1841, p. 781.) This is manifestly an iceberg, worn into pinnacles in its southern progress; but perhaps it is necessary to notice it here, as it has been placed on a recent chart as a permanent danger.

The Virgin Rocks, to the E. by S. of Cape Race; lat. 46° 26′ 30″, lon. 50° 55′ 20″.

These rocks form a dangerous reef, lying about 30 leagues *E. by S.*, *true*, from Cape Race; in gales of wind a heavy sea breaks over them, and a strong current, which sets about them, often increases the danger.

The existence of the Virgin Rocks having been questioned, it is proper to communicate the following extract of a letter, addressed by Arthur Kemp, master of the brig *Indiana*, of Dartmouth, to the publisher of the *Newfoundland Gazette*:—"On the 23rd of October, 1823, at noon, I left Cape Broyle, after a strong gale from S.E., with the wind at W.N.W., steering S.E. by S. The following morning, at eight a.m., having run 84 miles, I was alarmed with the cry of '*Breakers ahead!*' and almost immediately saw them, to such an alarming extent, as obliged me to alter the course from S.E. by S. to E. by N., it not being possible to clear them on the other tack. After giving the breakers a good berth, and leaving them to the southward, distant 4 miles, I hove the main-topsail to the mast, and lay by from ten o'clock till noon, and observed in lat. 46° 35′, lon. 50° 51′; the extent of breakers appeared to be about 2 miles, and were more tremendously alarming than I have ever experienced during the twenty-three years that I have (chiefly in this trade) commanded a vessel."

The reef has since been surveyed by Mr. Rose, master of H.M.S. *Tyne*, who, with Captain Bishop, of H.M. brig *Manly*, has ascertained its situation. The following are the particulars:—

The bank on which the shoal is situated extends E. by N. and W. by S. 4½ miles; its broadest part is about 2¾ miles. The soundings are regular from 28 to 30 fathoms, until they deepen suddenly on the outer edge to 39 and 43.

The rocks themselves are in 46° 26′ 30″ N., and 50° 55′ 20″ W. They extend in an irregular chain S.W. by W. and N.E. by E., 800 yards, varying from 200 to 300 yards in breadth. The least depth of water is on a white rock, in 4½ fathoms, with 5 to 6½ fathoms all round it; the bottom distinctly visible. Toward the extremities of the shoal are several detached rocks of from 7 to 9 fathoms, with deep water between, and with a currrent setting over them W.S.W. 1 mile an hour; and with also a very confused heavy swell.

The vessels were anchored upon the rocks for the space of two days, during which the weather was extremely pleasant, and every way favourable for taking the most accurate observations. The surrounding bank has been noted as a good fishery. Variation, 26° 30′ W.

Shoal on the Bank of Newfoundland, East of the Virgin Rocks, lat. 46° 30′.

A shoal, with only 21 feet water on it, was discovered by Jesse Ryder, master of the fishing schooner *Bethel* (belonging to Province Town, Massachusets), on the Grand Bank of Newfoundland. In lat. 46° 30′, having observed on the shoal, saw it distinctly, it

being a rock of about 100 or 200 feet surface; supposed it to be about 50 miles East of the Virgin Rocks. Shoal bears from Nine-fathom Bank S. by W., by compass, about 1½ miles; discovered it accidentally while searching for the Nine-fathom Bank to fish on. Was certain it was not any part of the Virgins, for I afterwards saw them, and, from my experience of the different fishing grounds, know this shoal to exist.

This information I obtained from Mr. Ryder himself, and took a sketch from one that he had in the American consul's office at this place.—*Walter Douglas*, Commander of the *Unicorn* steam-packet, Halifax, February, 1845.—*Nautical Magazine*, May, 1845.

Cashe's Ledge, in lat. 42° 56′ N., lon. 68° 51′ 30″ W.

"This is a dangerous reef, about half a mile in extent each way. Its soundings are very irregular, having from 10 to 4 fathoms in the length of a boat. There are 17 fathoms within a cable's length of it, deepening at a short distance to 90 fathoms, on the western side. On approaching the shoal you may find 60 to 35 fathoms, brown sand, with black stones and broken shells; then 30 fathoms, where it becomes rocky. The currents on the ledge are exceedingly rapid and devious. On the shoalest part there are said to be only 12 feet at low water. By observations made, on four successive days, by the master of H.M. sloop *Beaver*, the latitude is 43° 1′ 0″. The longitude has been deduced from that of Cape Anne as from 69° 6′ to 69° 12′."

Such is the statement, exactly as it appeared in this work since the year 1815, respecting this dangerous rock. Yet by a recent examination by the United States' coast survey, by Passed Midshipman Ammen, it is recommended to be called *Ammen's Rock*. As we see not the slightest reason for such change, notwithstanding the difficulty and perseverance shown in its exploration, the original name certainly must remain.

The latitude of the rock, deduced from the two days' observations, June 5th and 6th, 1849, is 42° 56′; the longitude 68° 51½′ W. The least water on this rock is 26 feet; a less depth has been reported by the fishermen, but they sound with their fishing lines, perhaps not accurately marked, and with a lead insufficient to press down or pass through the thick kelp that covers the rock. The extent, having less than 10 fathoms, is about half a mile in a N.W. by W. and S.E. by E. direction, and very narrow. It is surrounded by deep water at a short distance, particularly on the S.E. side, where the depth increases suddenly to 60 fathoms.

Shoal Grounds on George's Bank.

These shoals were formerly described under the respective names of *Brown's Bank* and the *Malabar Shoal*, by neither of which names are they now recognised. A copy of the report of an actual survey of them, made under the orders of Commodore Isaac Hull, by Mr. Felch, of the U.S. navy, and Mr. Edmund Blunt, jun., is contained in the *Colombian Navigator*, vol. i. p. 56. From this report it appears that there are, properly, four shoals on the bank, the whole of them included between latitudes 41° 34′ N. and 41° 53′ 30″ N., and longitudes 67° 18′ W., and 67° 59′ W. The largest, which is toward the S.W., is also the most dangerous. Between the shoals are from 15 to 35 fathoms of water.

But these shoals have since been accurately surveyed by *Lieutenant Charles Wilkes*, of the U.S. navy, and the officers under his direction, as shown by the chart, on a large scale, published, by order of the Navy Commissioners, in 1837.

It appears by this survey that the general direction of the shoal ground is N.W. by N., and S.E. by S., and it extends 13 miles in length, and from 1 to 2 miles in width; the depth of water within this space being 10 fathoms and less, but very irregular. The two shoalest places are between 41° 40′ 13″ and 41° 40′ 33″ N., and 67° 44′ 10″ and 67° 40′ 30″ W., and are knolls of hard sand, having upon them, at low tide, 15 feet of water. With the exception of these two places, the shoal may be crossed in any part by an ordinary sized vessel without danger. There is a rip usually the whole length of the shoal, and, at times, heavy breakers in the shoalest places.

A comparison of the latter with the former description affords strong reasons for supposing that the shoals are continually in a shifting state.

Nantucket Shoals, extending from Nantucket Island.

These very dangerous shoals, lying immediately in the line of traffic of the coasting trade of the United States, have been but very little known till within a very few years; and then their limits were more exactly defined at the expense of a private individual,

Mr. E. M. Blunt, of New York. These "Goodwin Sands" of the United States now, however, appear to be tolerably well examined, though still some doubt has been expressed as to whether their entire extent has been ascertained.

The ensuing particulars are derived from the reports of Lieutenant Charles H. Davis, U.S. navy, superintending the hydrographic parts of this portion of the coast survey. The danger of these formidable shoals will be much reduced by the new lighthouse on *Sankaty Head*, described on page 84, completed in 1849. This tower is 70 feet high, painted in three horizontal rings, and shows a dioptric flashing light every 1½, 1½, and 3 minutes,* at an elevation of 150 feet, consequently visible from the Old South Shoal.

The *Old South Shoal* has from 6 to 18 feet water on it, and is 2½ miles in extent. From its centre Sankaty Head bears *N.* 22° *W.*, *true*, or N. by W. ¼ W. by compass; distant 12½ miles.

From the middle of the *New South Shoal*, discovered in 1846 (8 to 18 feet, 1½ miles in extent), the middle of the Old South Shoal bears *N.* 4° *E.*, *true*, or N. by E., mag., distant 6¾ miles. No part of Nantucket Island is visible from it in the clearest weather.

From the middle of the ridge (4 fathoms), discovered in 1847, the centre of the New South Shoal bears *S.* 70° *W.*, *true*, or W. by S., mag., distant 4 miles. From the 16 feet shoal to the eastward of the Bass Rip, discovered in 1847, Sankaty Head bears *N.* 84½° *W.*, *true*, or W.N.W. ¾ W., mag.; and Great Point light (fixed) *N.* 49½° *W.*, *true*, or N.W. ¼ N., mag., distant 10¾ miles.

From the 14 feet shoal to the North of the Bass Rip, discovered in 1847, Sankaty Head bears *S.* 20½° *W.*, *true*, or S.S.W. ½ W., mag., distant 4½ miles.

The North end of the *Bass Rip* bears *E.* 0° 30′ *S.*, *true*, 3 miles; and the South end *S.* 30° 30′ *E.*, *true*, 4¾ miles from Sankaty Head.

The East end of the *Old Man* bears *S.* 15° 45′ *E.*, *true*, from Sankaty Head, distant 3 miles; and the West end *S.* 24° 30′ *W.*, *true*, from Tom Never's Head, distant 4½ miles.

Besides these shoals, the following, discovered in 1848, in the course of the survey, are to be added:—

1. A shoal 2½ to 3 miles long, making off from the southern extremity of Great Rip, with which it is connected by a short ridge of 3¼ fathoms. This shoal lies in a N. by W. and S. by E. direction, mag., and has only 8 feet on it in several places.

The distance between the eastern end of the South shoal and the new determination is only 6¾ miles, and the southern limit of danger on Great Rip is 15 miles from the shore. Vessels passing to the southward of Great Rip, or to the eastward of the old Nantucket South shoal, should be careful to govern themselves accordingly.

The centre of the shoal bears from Sankaty Head S.E. ¾ E., mag., and S. 62° 30′ E., *true*, 13¾ miles distant.

2. A small shoal, having only 8 feet of water on it in one spot, which bears N. ¼ W., mag., and N. 11° W., *true*, from eastern end of Old South Shoal, 4½ miles distant.

3. A small shoal, with 16 feet on it, a little to the northward and eastward of the preceding, bearing N. by E. ½ E., mag., and N. 7° 25′ E., *true*, from Old South Shoal, 5¾ miles distant.

4. A small shoal with 13 feet on it, to the eastward of South end of Bass Rip. The middle of this shoal bears from Sankaty Head S. by E., mag., and S. 65° E., *true*, 6 miles distant.

5. A very small shoal spot, having only 10 feet of water on it, North of Bass Rip, and 1 mile distant from the shoal discovered in that vicinity in 1847. This spot bears from Great Point light S.E. ¾ E., mag., and S. 62° E., *true*, 6 miles distant.

The ground to the northward, and to the northward and eastward of the Old South Shoal, is broken, dangerous, and marked by occasional strong tide rips.

Coasters taking the outside way, are advised to follow down the East side of Bass

* The apparatus by which this light is controlled is described on page 13 (sec. 39). We might object to the complicated variation of the light in its irregular interval. Indeed the system requires close watching, or it might be mistaken for a fixed light if seen through driving fog or rain, as the flashes are but of short duration.

Rip, and passing over the tail of it in 4 fathoms, to haul round under the South side of the Old Man, which (it is always visible) it is best to keep in sight. Here they will have a good beating channel of at least 2 miles, *i. e.*, from half a mile to 2½ miles from the Old Man. Vessels taking this course with an ebb (or westerly) tide will clear the shoals in a few hours. They will also have more room, and be more favoured by the prevailing westerly winds than in the sound.

6. A long bank to the eastward of the shoal, marked No. 1 on this list, upon which I found four (4) fathoms in two places, 4 miles apart. The sea was breaking on it whilst I was there, the result of a heavy swell from the southward and eastward.

I was unable to determine the extent of this bank, owing to the bad weather and the lateness of the discovery. The further examination of this bank next season will be a point of great interest.

In October, 1849, six more shoals, of small extent, but not the less dangerous, having from 9 to 14 feet, were discovered and placed by Lieutenant-Comm. M'Blair to exist to the northward of these. They lie generally about *East, true*, from the Great Point light of Nantucket Island, at distances varying from 9¼ to 11½ miles off. They are sharp, abrupt ridges of fine white sand, which are readily discovered by the rip of the tides at all times, except at slack water, but by daylight they exhibit the usual discoloration.

Notwithstanding all the examinations of this locality, there is some reason to believe in the existence of more shoal patches, farther off the land than the foregoing.

"December 2, 1849, the ship *Marmion*, Captain Freeman, from Liverpool, when in lon. 69° 29′ W., lat. 41° 5′ to 41° 1′, got in between two tide rips, which broke; soundings in 21 fathoms, and on steering S. by E. to S. by W., found as little as *seven* fathoms." Again, Captain R. F. Hartshorn, of the ship *E. Z.*, July 20th and 21st, 1850, "during two days I was beating between lat. 41° 10′ and 41°, and lon. 69° to 69° 40′ W., the fog thick, several times shoaled the water suddenly from 20 fathoms to 8 and 7, steering S.S.W. to S. by W. I am certain there must be a shoal spot in the neighbourhood of 69° 30′ or 69° 35′, and lat. 41° to 41° 8′. I had the lead constantly going during the fifty-six hours, and the soundings differed very materially from Blunt's Chart soundings." These positions would place it to the eastward of the bank discovered in 1848, marked (6) above. Caution ought to be used in approaching the vicinity.

America Rock, lat. 40° 20′ N., lon. 63° 50′ W.?

A notice was given in a New York paper, copied from a Bermudian paper, that the commander of the bark *America*, of Baltimore, discovered a rock projecting 25 to 30 feet above water, and about 300 feet in circumference, September 1, 1846: lat. 40° 20′, lon. 63° 50′. It is very improbable indeed that this could have been a rock; it looks more like a *wreck*, from the fact of its being in the highway of shipping, and its locality having been crossed at least four times by the *Great Liverpool* steamer alone, in 1838-39.*

It may have been a large tree, perhaps brought down by the Mississippi, and launched into the Mexican Gulf. An example of this is given by Captain G. P. Lock, of the *Martha Shalla*, of Liverpool, who, being becalmed in the neighbourhood of Munn's Reef (or lat. 39° 45′ N., lon. 64° 10′ W.), was surprised to hear the announcement of a boat's approach; but, on referring, it was supposed to be Munn's Reef. A boat was got out to survey, when it was found to be a very large tree, roots upward, and 40 feet in circumference, and surrounded with shoals of fish. Had it not been so closely examined, it would have been again announced as Munn's Reef.†

IMAGINARY SHOALS,

between the parallels of 40° and 50°, formerly described, but now omitted, from a conviction of their non-existence.

Land of Bus, sunken, near 58° N., and 33° W.; *Negres' Rocks*, lat. 48° 7′, lon. 21° W.; *Ramigeau's Vigia*, lat. 42° 42′, lon. 37° 30′; *Barencthy's Rock*, lat. 45° 33′, lon. 37° 25.′

* *Nautical Magazine*, 1847, pp. 161, 493.

† *Ibid.*, May, 1848, p. 257.

BETWEEN THE LATITUDES OF 30 AND 40 DEGREES.

DÆDALUS ROCK, off CAPE St. VINCENT, in about 36° 30′ N., and 9° 16′ W.

The old charts of the Atlantic indicated a danger at the distance of 12 or 15 leagues to the S.W. of Cape St. Vincent. This danger was omitted in the French chart of 1786, and subsequently in other charts, from the supposition that, if it really existed, it must have received some modern confirmation. But it seems, from information communicated by Captain Taylor, of the brig *Laurel*, of Whitby, that, in about 1813, the *Dædalus*, transport, struck on this rock, and received so much damage as rendered it necessary for her to put into Lisbon for repairs. Captain Taylor was in the fleet when the *Dædalus* struck.

Added to this, the brig *Briton*, Captain Stokes, was lost, in consequence of striking upon the rock, in December, 1821. After she struck, she swung off, and then immediately tried for soundings, but got none. On finding the vessel striking, the people took to the boat, and were picked up by another vessel. Captain Stokes had not seen Cape St. Vincent, but supposed it, at the time, to bear N.N.E. ½ E. 28 or 30 miles. This information has been communicated by Captain Livingston, who says, "This information was given to me in Malaga, in September, 1822, by Captain T. Tankersly, of the schooner *Lord Mulgrave*, of London. Captain Tankersly added, that he had met with another master (name forgotten), who said he had observed the sea-weed on this rock; got out of his boat, and held on by some of the weed. He supposed the rock to be about 50 yards in circumference."

The preceding information is from Captain Livingston, who also says, "I was some years since informed by an old man of colour, a native of Goa, who was steward of a vessel I then commanded, that, while he was cabin-steward to Sir Edward Pellew, while captain of H.M.S. *Indefatigable*, she struck on a rock off *Cape Finisterre*. This, I understand, has been denied, and it appears truly; for I have now information on which I can rely, from a very respectable naval officer, whose name I do not consider myself at liberty to mention, that the *Indefatigable*, when commanded by Sir Edward Pellew, actually struck on the rock, or a rock, off *Cape St. Vincent*, and received some damage. I had no doubt, before, that she had struck somewhere, as I had perfect confidence in my old steward's veracity: the error was in memory only."—(*Letter*, *28th October*, 1822.)

The existence of this rock was confirmed on the 6th of March, 1839, by Mr. John Aves, commander of the schooner *Tantivy*, of Plymouth. At 9ʰ 30′ p.m., this vessel, on her voyage from Zante, passed close to the eastward of it; it was not seen till close aboard, and not avoided without difficulty. There was a swell from the N.W. breaking over it, and a sheet of foam, about 20 to 25 fathoms in circumference. The *Tantivy* stood in N.N.E. on the starboard tack, till 7 next morning, then tacked to the southward, passing the cape at the distance of about 2 miles. The rock was thus estimated to lie considerably to the eastward of its position, as shown by chart, and to bear about S.S.W., *true*, 37 or 40 miles from the cape.

CLEVELAND REEF, off CAPE GHIR, or GEER?

This reef, or bank, said to have been discovered by Captain Cleveland, R.N., in 1765, in lat. 35° 45′, at about 9 leagues from the coast, was diligently sought for by the *Ætna* and *Raven*, on survey, in 1835, without success; and it has been accordingly erased from the charts.

FALCON ROCKS, to the Northward of PORTO SANTO.

The situation of these rocks has been already given in the description of the Madeiras, p. 419. They had previously been vaguely and erroneously described as a bank, on which Francis Doublet, of Honfleur, grounded, to the N.E. of Porto Santo; and as a ledge on which a Dutch ship was lost. It is most probable that it is the same shoal as the Eight Stones, next described.

THE EIGHT STONES, to the Northward of MADEIRA?

A very extensive and dangerous reef, according to M. D'Aprés, was discovered by a Captain Vobonne, of London, in 1732, and subsequently seen by a vessel going to the West Indies. Eight rocks were said to be seen, even with the surface of the water, and situate between 34° 30′ and 34° 45′ N., near the meridian of 16° 40′ W. This object

has, therefore, for a century past, been alarming the navigator; but sufficient evidence, we think, has been given to prove its non-existence, at least, in the reported position.

Independently of the opinions of several mercantile friends, the routes of the following ships and vessels of the British navy seem conclusive:—On the E. and N.E. of the assumed position, we find, in 1828, the *Southampton* and *Chanticleer*; in 1829, the *Blossom*; in 1832, the *Beagle*; in 1833, the *Ætna* and *Raven*; more to the West, beyond the meridian of 16°, in 1825, the *Martin*; and in 1828, the *Emulous*; beyond these, westward, the *Raven* and *Sulphur*, in 1836; and the *Blossom*, in 1825, which passed from the northward directly over the spot. In 1831, the *Ætna* likewise passed over it, and pursued her course thence toward Porto Santo. The *Ætna* again, in 1836, more to the West, sounded near the meridian of 17°, but found no bottom at 200 fathoms. The same ship, in 1833, passed in an East and West direction directly over the supposed centre of the shoal, but found no bottom at 70 fathoms.

These particulars we have gained from a small chart, exhibiting the different routes, which was given in the *Nautical Magazine* of July, 1837.

Captain FitzRoy says:—"On the 3rd of January (1832) we were occupied in looking for the '*Eight* Stones;' but nothing was seen to indicate either rocks or shoals, or even shallow water. The sun was shining brightly on a deep blue sea, of one uniform colour; no soundings could be obtained; and had there been a shoal or rock within 7 miles of us at any hour of that day, it could not have been passed unnoticed. So many vessels have searched, in vain, for this alleged group of rocks, that their existence can now hardly be thought possible."—*Voyage*, vol. ii. p. 46.

But the following may afford some light on the original announcement:—A traditional statement is repeated among all the older inhabitants of Porto Santo, that, at a former and very distant period, a large ship had been lost on the North-west Baxio, an extensive shoal or fishing bank, now marked on the charts as the Falcon Rocks. But old persons who live on the heights of Porto Santo, from whence the sea still, at times, is seen to break with great fury on the Baxio, state that the sea, in this respect, is by no means what it was formerly, when the rocks, they say, *often appeared*; leaving thus the almost inevitable conclusion, that they have washed away with the constant working of the sea; and looking at the formation of some of the smaller volcanic islands or rocks, which surround the larger one of Porto Santo, having all a limestone base, it is easy to see that the basalt columns, which resist the sea, all stand on a red or brick-coloured tufa, which the sea in time eats away; and the basalt columns, being consequently undermined, fall down and lie prostrate, as you must have observed, at the bottom of every high cliff, where many, very many, of these basaltic columns, with their bases of red tufa decomposed or wasted away, are still hanging almost in air, ready to fall, as they daily do. And it may reasonably be supposed, from the tradition of the inhabitants, that this rock, or the troubled sea upon it, was formerly far more apparent and awful than at the present time, and that the pinnacles of this extensive Baxio, composed, as it most probably was, of basalt rocks, has, like others of the same nature, been undermined, and fallen into deeper water, the shoal in its extent affording now from 5 to 50 fathoms on it.—(A communication from *Antonio Pedro de Arevedo*, Captain Royal Engineers, Madeira, November 17th 1842.*)

It has been suggested, that volcanic agency may have caused the subsidence of the shoal; but as all the vicinity, which is entirely volcanic, has been quiescent for ages, there is no great reason for supposing such to be the case.†

* *Nautical Magazine*, 1843, p. 100.

† The same cause also has been thought to have occasioned the pheuomena of *rollers*, or a confused sea, which has been sometimes experienced near this part. Our respected correspondent, Captain T. Midgley, states, "On the 29th December, 1840, the ship *John Campbell* was in lat. 33° N., and lon. 19° 24′ W., about 2 degrees West of Madeira, and with a light wind from S.S.E.; the ship, about 2 p.m., got suddenly among some rollers. At first these rollers did not appear alarming, as the vessel, on her gradual approach to them, seemed to be only experiencing a gradually rising sea. But the rollers soon attained a considerable height, and set in regular ridges from the *N.W. quarter*, toppling in many places like a bore, and causing the vessel to labour and roll heavily to windward. In the evening there was an increasing breeze from the S.E., with cloudy, overcast weather, and much vivid lightning in the *N.W. quarter*, and which had been previously seen. As the weather had been moderate for several days before, I can scarcely think these rollers could have been caused by wind, as

PRONK ROCKS, West of the AZORES, lat. 38° 32′ N., lon. 33° 16′ W.

Captain A. Pronk, of the Dutch bark, *De Hoop*, reported, that on his passage from Batavia to Rotterdam, in the North Atlantic Ocean, near the Azores, April 6th, 1844, in the afternoon, sailing with a strong breeze and fine weather, being on the quarter-deck with his officers, they were much alarmed by some of his people in the foretop calling out that they saw a large rock close by on the lee-bow. The captain immediately ordered the helm to be put down, and the vessel luffed up 3 or 4 points to avoid the danger; with astonishment, they saw several rocks, plainly visible from deck to every man on board. They passed them within a cable's length, and Captain Pronk says that it was an extensive group of rocks, with several points above water, some of them more than 16 feet in height, against which the sea broke furiously. The captain places this danger in 38° 32′ N., and 33° 16′ West of Greenwich, by very good observations and chronometer; the next day they saw the Western Islands, and found the longitude by chronometer very exact.

The foregoing was communicated from the Dutch newspapers to the *Nautical Magazine* by Captain F. Fohkens, of the Dutch ship *Roon and Pendrecht*. It is possible that it is of recent and volcanic production, and may be connected with the following, which have been seen in the vicinity.

CONSTANTE REEF, lat. 37° 56′ 20″, lon. 34° 4′ 8″; and FERREIRA REEF, lat. 38° 26′ 44″, lon. 30° 25′ 10″ W.

The notice of these two reefs we find in the *Nautical Magazine*, December, 1840, p. 881, as follows:—

"We understand that her Majesty, the Queen of Portugal, having seen the official communication of the Major-General of the Fleet, under date of the 8th instant, transmitting the report addressed to him by Manoel Marriano Ferreira, captain and chief pilot of the Brazilian brig *Constante*, respecting two sunken rocks which he saw and approached closely, on his recent voyage from Paraiba to Lisbon; and it being most important to ascertain the position of the said two rocks, neither of them being found marked in any of the charts; orders that the said Major-General shall cause the first vessel of war, destined for those seas, to take a survey of the said rocks, in order that their position and other circumstances being ascertained, this notice may be afterwards ratified."

The following is the report referred to in the above:—

"I, Manoel Marriano Ferreira, pilot, while navigating from Paraiba to Lisbon, on board the Brazilian brig *Constante*, as master and chief pilot thereof, and being to the westward

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they were very unlike the sea that marks the termination of gales of wind; they came in regular ridges, and sometimes topped in a considerable breaker. The ship was suddenly among them, and sailed for 21 miles through them; the rollers rapidly increased, and as rapidly subsided. The sea was of a deep dark-blue colour. No bottom at 70 fathoms; barometer steady at 30·20; the temperature of the air, 64°, and of the water, 57°, of Fahrenheit's thermometer.

"After much consideration of the subject, I must candidly confess my inability to assign any just cause or reason for this sudden, and to me unaccountable, undulation of the surface-water; but, perhaps, some such occurrences may have an influence in contributing to the sudden rise of the water which is occasionally experienced at Ascension, and, I believe, also, at some other elevated islands."

A precisely similar phenomenon was also experienced 2 degrees northward of Madeira, by the bark *Lady Mary*, Mr. E. G. Tomkins, master, just one year after the former. "On Dec. 29th, 1841, in lat. 34° 44′, and lon. 17° 30′ W., with a light breeze from the eastward, experienced a very unaccountable, but heavy, swell from the N.E. It commenced about 3ʰ p.m., and at 8ʰ had reached its height, breaking, at times, over the vessel in an alarming manner. We had not much wind for two days previous, nor had we a strong breeze afterwards till over the line.

"It resembled as much the boiling of a caldron as anything I could imagine, but was very unlike a sea or swell occasioned by wind. At midnight, it had gradually subsided. All this time we had been rolling gunwales under at each side."—*Nautical Magazine*, February, 1843.

In the recent edition of the *Ethiopic Directory*, pp. 32—34, we have endeavoured to show that these rollers may be occasioned by distinct hurricanes; these examples will tend to confirm that supposition, though they may not have resembled the effects of wind, as experienced at the time the wind blows. It is not at all necessary that any volcanic action should have caused them; for it to have raised such a sea, some other effects would have been evident.

of the Azores, near the parallel, and not very distant from the meridian of some sunken rocks, marked in Norie's chart as doubtful; at 10 a.m., on the 26th of August, 1840, sailing in a northerly direction, with light winds from the E.S.E., saw breakers to windward, at the distance of 1 or 2 miles. Shortly after it fell calm, and my vessel remained in the same position for six hours, and in sight of the said breakers, so that I got the boats out to keep her head away, and tow her out of danger. At noon, it being then high water at that place, the surf had nearly disappeared; at 2 p.m., it again became perceptible, and at 6 p.m., a group of rocks was clearly visible above the water. By the latitude I had observed at noon, and the longitude given by a good chronometer, and the rock being about 1¼ miles distant from me, I compute their situation to be in lat. 37° 56′ 20″ N., lon. 33° 4′ 8″ West of Greenwich.

"As the wind freshened, at 6 p.m., I made sail again, and having arrived in three days in sight of the Island of Flores, I found that my chronometer was perfectly correct.

"The wind being East, I tacked to the southward, and on the 31st of August I passed near another sunken rock, which is marked in the said chart, as having been seen by Captain Robson, to the northward of Fayal. At 8 a.m., I saw some rocks above water, over which the sea broke, and which I passed to leeward, at the distance of 1 to 2 miles. By observation and the chronometer, I calculate this second danger to be situated in lat. 38° 26′ 44″, lon. 30° 25′ 10″ W. of Greenwich, all which I certify without any doubt." —*Lisbon*, 6th October, 1840."

The first of these reefs has been named the *Constante Reef*, and the second, *Ferreira Reef;* they have been previously noticed, together with the *Pronk Rocks* (Rhoon Rocks, in the *Nautical Magazine*), on p. 417. Considering the volcanic nature of the neighbourhood, and the vast changes that have been effected by that agency in a very short period of time, we may suppose that they form a portion of the same volcanic system, and have been formed at a recent period. At all events much circumspection is necessary in sailing through these parts.

HILTON ROCKS, West of the AZORES, lat. 39° 18′, lon. 35° 50′.

"Bark *Secret*, Mr. Robert Hilton, master, from Valparaiso toward Liverpool, May 12th, 1845. While observing a meridian altitude, breakers were reported; they were of no great extent, but Mr. H. plainly saw some objects in the hollows of the waves, which he felt perfectly certain were heads of rocks. The swell was not very heavy, and he thinks, in smooth water, they would be nearly on a level with the surface of the sea. The breakers were about 1¼ or 2 miles S.W., by compass, from the vessel, and at the time she was running 7½ or 8 knots, with steering sails set, so that there was not much time for very particular remarks.

"The latitude stated, 39° 18′ N., lon. 35° 50′ W., was from meridian observation, and the longitude from the mean of these observations; viz., their own chronometers,—the chronometer of a ship in company, and a lunar taken by Mr. H. himself, the same afternoon."—Communicated to the *Nautical Magazine* by Captain A. Livingston, August, 1845.

This reported shoal lies to the N.W. of the Pronk Rocks, but the positions ascertained would, perhaps, be conclusive against their identity. It is much to be regretted that, in this and many similar cases, some little trouble is not taken to place these matters beyond doubt and uncertainty; they remain, perhaps for many years, without being confirmed, and thus only "disfigure" the charts, and are a source of anxiety and annoyance to the navigator.

JEAN HAMON'S ROCK, in lat. 36° 54′, lon. 19° 49′?

The existence of this danger rests solely on the authority of Jean Hamon, commander of the *Trois Amis*, of Bordeaux. On the 8th of January, 1733, according to M. Bellin, he approached it within three-quarters of a league, and carefully observed it. He calculated its position by the course and distance run from the discovery of it until his arrival at the Rock of Lisbon, which he made to have been E. by N., *true*, about 165 leagues. The late Captain Goodall, a gentleman long and well acquainted with the navigation of this part of the ocean, informed us, that he did not believe the danger to exist, and we are of opinion that it may safely be obliterated.

WHALE ROCK, in about lat. 38° 46′, lon. 25°?

M. Fleurieu exhibited this rock on his chart of the Azores, at about 29 leagues from St. Michael's, upon the report of a pilot, whom he knew at Angra, in Terceira. Its

existence has, however, been disputed. The breakers shown on the chart, which were very high, were seen by Mr. R. Gradun, commander of the ship *Harmony*, of London, on the 8th of January, 1809: their latitude, by observation, being 38° 46′; and longitude, by account, 24° 47′. This affords reason for believing that the rock exists, the situation assigned by Mr. Gradun being very near that stated by M. Fleurieu.

Mr. Reid, late British consul-general at the Azores, believed it really to exist; several masters of vessels, who have been blown to sea from St. Michael's, having told him that they have actually seen it, and that, in form, it much *resembles a whale*. The rock has lately been diligently sought for, under an order of the British Admiralty, but without success; and it now seems clear that it cannot lie in the situation assigned by Mr. Gradun; yet it is still believed to exist not far off.

Captain Livingston says that, "While at Malaga, in September, 1821, Captain Finlayson, of the *Duke of York* schooner, of Portsmouth, informed me that some years since, when Captain Bartholomew, R.N., was at St. Michael's, about the time he was sent by the Admiralty in search of the Whale Rock, the *Nautilus* schooner, of Plymouth, arrived at St. Michael's. After Captain Bartholomew's departure, the commander of that vessel told Captain Finlayson, that, on his passage out, having a chronometer, he remarked to his mate that, if the Whale Rock existed in the situation assigned to it, they must pass near it. Accordingly, in the mate's watch that night, the vessel ran through a very heavy break, which alarmed them much; but, before they had time to take any precautionary measures, the vessel was again out of the broken water, and the captain believed they had passed close to the Whale Rock. No person about Angra seems to doubt its actual existence; and one man, I understand, gives a very distinct account of its appearance and situation, having, when he saw it, carefully noted particulars in his journal: he is an Irishman, mate of a trading vessel between Angra and Lisbon, but unfortunately was not at Angra when I was there. The last time Captain Bartholomew was at Angra, this man was introduced to him, and stated, on being shown Captain Bartholomew's former tracks in search of it, on the Admiralty chart, that he never had been near its actual position."

TULLOCH REEF, in about 37° 27′ N., and 24° 45′ W.

This reef was discovered in 1808, by Captain William Tulloch, of the brig *Equator*, of Portsmouth, New Hampshire, on a voyage from Madeira to St. Michael's, as already shown and described in page 403.

It may be remarked that Captain Tulloch observed, from their black cindery appearance, that the rocks had risen from volcanic impulse; and it is therefore possible that they may have disappeared.

ST. MARY'S BANK, to the S.W. of the ISLAND OF ST. MARY, in about 35° 53′ N., and 27° 19′ W.

"On our passage, in 1819, from Havana to Barcelona, we passed over white water, apparently a shoal, to the southward and westward of St. Mary's: the captain would not allow the vessel to heave-to, in order to sound: but I have no doubt in my mind of its being a very extensive bank of soundings; and I have little doubt that I have ascertained its position, tolerably accurate, from lunars, prior and subsequent. I should not be surprised if it turned out that the bank we passed over was connected with the *Kutusoff Bank*, marked, in the last edition of Admiral Espinosa's chart, as having been seen in 1816, and which lies to the S.W. of the one we passed over, at the distance of about a degree. We were some hours crossing the bank.

"The bank lies in lat. 35° 53′ N., as calculated, by account, between the observations of the noon before and noon following; lon. 27° 19′ West of Greenwich, calculated from lunars, taken two days before and three days after, corrected by account. I have heard a French gentleman, a lieutenant de vaisseau, mention what I suppose to be the same, at the table d'hote, at St. Michael's, in October, 1818.

"I am of opinion that this bank, when better known, may be of use to vessels coming across, for determining their position by; and it is to be hoped that some of his Majesty's vessels will survey it; for, however much the master of a merchantman may be inclined to do so, he must not delay his vessel."—*Andrew Livingston.*

JOSYNA ROCK, in lat. 31° 40′, and lon. 23° 45′?

On this danger, it has been stated that the *Josyna*, of Flushing, was lost, in August, 1697. The latitude observed, and the distance 110 leagues from Madeira. In the last

Spanish chart, it is said to have been seen in the year 1805. This places it in lat. 31° 40′, lon. 23° 45′, as above, the position in which it will be found in the chart.

"John M. Gilchrist, master of the brig *Jewess*, of Liverpool, reports that on his passage from Bahia, on the 1st of January, 1848, at about half an hour after noon, in lat. mer. alt. of the sun that day, 23° N. (*sic*), by 24° 28′ 30″ W., by forenoon and afternoon sights for a chronometer, which on making Madeira, and arrival at Gibraltar proved correct, saw at about a quarter of a mile distant, bearing S.E. by S. by compass, something which at first appeared to be a fish sporting in the water, but upon taking the glass and looking at it, appeared like a flat rock just awash with the water. As the Josyna Rock, by some considered doubtful, is supposed to be situated somewhere thereabouts, this notice may serve to put mariners on their guard. N.B. A brig at a short distance, which was running, appeared to haul to wind several points for half an hour, and then continued her course."

We copy the foregoing from the *Nautical Magazine*, March, 1848, page 160, as posted at the Liverpool Underwriters' Rooms. The latitude is there stated to be 23°, but the reference to the Josyna Rock leads us to the assumption that it is an error for 33° N. The account seems very vague, but it is right to mention it, and we leave it in great doubt, for future determination.

Falconer Rock, off Fayal, lat. 38° 40′ N., lon. 29° 8′ W.?

The bark *Johanna*, Captain W. Falconer, on July 13th, 1847, passed what was supposed to be a *rock*. "As two of the men were on the flying jib-boom furling the sail, they reported a rock close upon the lee bow just awash; it was some ten minutes before we on deck could understand what they said, being thick weather, with drizzling rain, and blowing fresh; they were perfectly sure it was a rock. It was five a.m. when the rock was reported, and at noon Point Rosales, St. George, bore S.S.W. ½ W., and Graciosa, middle, N.E. by E., making a run from five a.m. till noon, E. ½ S. 35 miles, bearings by compass." (These bearings will place the spot in about lat. 38° 40′ N., lon. 29° 8′ W., or about 12 miles N.W. of the end of Fayal.)

The above account, taken from the *Nautical Magazine*, November, 1847, page 580, is somewhat vague, and it may have been some floating object, still it would seem that its nature was confidently stated. It is not impossible that such a rock may exist hereabout, and still have escaped the notice of the accurate Admiralty surveyor, Captain Vidal, in 1844 (see his remarks on the Tulloch Reef). The position lies in the direct line of the apparent volcanic action and the range of the islands, and moreover the chargeable nature of these submarine peaks in this vicinity may have brought it into view recently. We can only recommend caution in placing this, at present, doubtful danger.

Candler's Rock, in about 39° 47′ N., and 34° 29′ W.?

This rock, to the westward of Flores, said to have been seen, a few years ago, by Captain Candler, of the *Betsy*, of Boston, who thought it to be 100 feet in height, is now believed to have been an iceberg only, and, therefore, to be expunged from the charts.

Chantereau's Shoal, in lat. 38° 27′, and lon. 38° 0′.

This shoal, which has been described as a white rock, was seen by Captain Chantereau, of the ship *L'Auguste*, in coming from Martinique, 6th September, 1721, when the sea broke on it very much. It was again seen by Lieutenant Edm. Scott, commanding the *Princess Elizabeth* packet, 24th of April, 1828, and that gentleman has given the following account of it:—"On the 24th of April, 1828, at three p.m., I came on deck, and immediately observed the water round the ship very green, and with every appearance of being in soundings; and, on looking before the starboard beam, saw under water, at the distance of 2 cables, what evidently appeared, to the master and myself, to be a white sand-bank or rock, which the water did not then break on, but it appeared so very plain that there could not be much water on it. In extent it was about 1 or 1½ cables E. by N. and W. by S., *true*, and about half a cable in breadth.

"Immediately on observing the shoal, I ordered the lead and line up; but, ere it was ready, the colour of the water had changed to a deep sea-blue, when it was evidently useless to sound; at that time we were about a mile from the white spot; we had, at the time, a good breeze, but very little swell of the sea. I obtained two sets of lunar

distances the day before; and at noon, on the 23rd, had taken myself, with a sextant, the meridian altitude *very particularly*, in order to obtain the time correctly for lunar distances, on the opposite side to those previously taken, and which I did obtain, and made the latitude of the shoal 38° 16′ N., and, by the mean of the lunars, which differed very little, 39° 48′ 49″ W. Owing to a defect in my chronometer, I was not enabled to bring forward the longitude by it, but every care and attention in my power has been taken to give its correct situation."

This shoal, perhaps more than one, would certainly seem to exist, for it has again been seen. According to a notice inserted in the late official copies of the *Derrotero de las Antillas*, often quoted in this work, and dated Madrid, July 4th, 1846, a shoal, or vigia, was discovered at three p.m., May 21st, 1846, in fine weather, by D. Gabriel Perez, captain of the Spanish merchant ship *Leontina*, in lat. 38° 27′ N., lon. 37° 57′ 10″ W. of Greenwich, according to observations made shortly before seeing the (*Escollo*) rock, and confirmed by chronometer in making Graciosa (Azores) soon after.

Now, although the position be not very accurately determined, it must be supposed to approximate to it, and as the positions assigned to Chantereau's vigia are manifestly imperfect, it may for the present be taken that they all refer to the same spot, but of doubtful position.

Breton's Rock, about lat. 39° 40′, lon. 41° 35′.

This shoal, according to M. Bellin, was seen by Breton, a pilot of Rochelle, who marked it merely as a rock. Laisné, another pilot, has also placed it in nearly the same latitude and longitude. It may be the same as that which Roland, a pilot of Tremblade, sounded, and also seen by Jean Desmaries; there being scarcely 10′ difference in latitude, and in longitude not more than 1°. The situation originally assigned was 39° 45′ N., and 41° 25′ W.

This danger was again seen in 1816 by the ship *Tiger*, on her passage from Barbadoes to Liverpool. The letter of a passenger states that, "On the 14th of March, at ten a.m., a smart breeze from the S.W., with studding-sails set, going 7½ knots an hour, steering E. by N., *true*, in lat. 39° 40′, lon. 41° 40′, we passed over a very agitated rumbling sea. Under our starboard bow, in *appearance* about a circle of a mile, was a small field of dark brown rockweed, apparently a confirmed fixture; entangled with the weed were two pieees of spar, seemingly very much decayed. I am positive that this is a danger which ought to be carefully avoided by all ships coming to Europe from the West Indies and America, as it lies directly in the track."—(*Newspaper*, April 15, 1816.)

We are still at a loss for the position of the shoal, as it does not appear to have yet been correctly ascertained.

Columbine Shoal, lat. 35° 25′ N., lon. 49° 1′ W.?

The *Columbine*, Robertson, from Aux Cayes, on April 2nd, (1844?) at three p.m., being in lat. 35° 25′ N., lon. 49° 1′ W., saw discoloured water to windward; it had a brown appearance, extending above 100 feet in a S.S.E. direction, and about 30 feet across. It had all the appearance of a rock under water; the vessel was then little more than her length North of it, steering E.N.E.; immediately on the weather bow two more brown spots were seen close to each other, about 150 fathoms or more East of the one she was abreast of; the first lying in the same direction, and about the same size; the second or easternmost one of an oval shape, about 60 or 80 feet across, and appeared to be nearer the surface of the water than the other two. There was a light breeze from the S.E., the water was smooth, and not a cloud in the sky at the time; but there was a swell from the N.W. The sea did not break over these places. The discoloured water last mentioned was seen for nearly a mile.—*Shipping Gazette*, May, 1844.

We have here an instance of carelessness which is often to be deplored, and highly reprehensible. The commander of the *Columbine*, with every circumstance of wind, weather, and sea in his favour, did not decide, by a single sounding, most easily made, whether this was a real danger, or merely discoloured water, which must be supposed to abound in this centre basin of the Atlantic in the calm regions. If it be a danger, it behoves every sailor passing this vicinity to endeavour, by *sounding*, to establish its real character; for supposing it to be a sunken bank, not dangerous, such positions, well ascertained, serve as excellent points to correct dead reckoning; and left undecided, they

disfigure the charts, and cause much embarrassment and apprehension from all who have to pass their neighbourhood.

Under these circumstances we have marked it as doubtful.

ANNA ROCK, lat. 39° 30′ N., lon. 50° 30′ W.?

Extract from the log of the Sicilian brig *Anna*, Marco Carmelich, master:—"Tuesday, June 8th, 1841, p.m., ship sailing with all sails set. At three p.m., observed a shoal to the South, distant about 2 miles, appearing to the eye like a *ship with three masts of equal height*, and inclining towards the South, and about 50 feet high, surrounded by shoals, level with the water. Wind at the time S.E. by S., weather moderate and clear. Latitude, calculated from that observed at noon, 39° 32′ N., lon. 50° 50′ W. The weather being unfavourable, the master could not make any local observations, and was obliged to pursue his voyage to Naples."

We give this as we find it; perhaps it might have been the wreck of a ship drifting on the Gulf Stream.

MUNN'S REEF, in about 39° N., 64° 20′ W.?

This shoal was seen by the brig *Joseph Hume*, of which Mr. Alexander Munn was mate, 22nd of August, 1827, on her passage homeward to Liverpool. "The vessel passed close to it; they saw the white sand above the water, and sounding where the vessel then was, found 20 fathoms sandy bottom, a quarter of a mile off: then bore up, and sailed westward of it, in deep water."

The master would not allow the mate to examine the shoal; but from the brig's masthead the latter observed it to be of a horseshoe form, the opening of the shoe facing the S.W., and it appeared in length to be not more half or three-quarters of a mile, on the southern edge of the Florida Stream.

This information was communicated by Mr. Munn, through the medium of Captain James Porter, of the bark *Science*, of Greenock. The position of the shoal, by *observation*, is yet to be determined.

In the passage of H.M.S. *Thunder* from Bermuda to Halifax, in 1835, the ship hove-to for the night, in order to search for this shoal, but it was not found. The *Sapphire* frigate had passed over the spot at noon of the day before, but likewise unsuccessfully; yet, as vessels from Jamaica, Honduras, &c., may possibly have grounded on this reef, and have, consequently, foundered at sea, it claims a future and rigid examination. But see page 508, relative to a large tree having been found by Captain G. P. Lock, near this position.

FIELD'S VIGIA, lat. 37° 31′, lon. by account, 66° 0′?

An account of this vigia was published in the year 1833, but we are strongly inclined to think that it might be only a collection of weed, &c., in one of the southern eddies of the Gulf Stream, where, in abundance, it is frequently found.

Schooner *Little Mary*, Captain Fields, from Antigua to St. John's, N.B., 1st April, 1833:—"At four a.m., tried the temperature of the water, and found myself in the Gulf Stream. At six a.m., the water still warm. At eight, found the water very cold, and of a dark and muddy colour; every appearance of being on soundings. At about a mile to the westward the surface of the sea appeared as if breaking, or rather rolling, over a shoal; saw great quantities of small fish rise occasionally in scholes, and porpoises. At ten, found the water warm again, and of the blue ocean colour, and continued so until four p.m. of the 2nd. Latitude of shoal, corrected at noon, 37° 31′ N. Longitude, by account, 66° 0′ W. Partly determined to return and sound; but the wind was fair, and as there was also every appearance of a N.E. snow-storm coming on, was deterred from doing it. On making the land within the Bay of Fundy on the 6th, the reckoning was only 18 miles of longitude to the West of the vessel; and having sighted Bermuda on the passage, the longitude given of the shoal cannot be far from the truth."—*Journal.*

ANFITRITE SHOAL, in lat. 35° 50′ N., lon. 66° 4′ W.

An official notice from the Spanish Hydrographic Direction states that the Spanish merchant ship *Anfitrite*, in her passage from the Havana to Cadiz, in May 10-12th, 1846, discovered a patch of broken water, about a cable's length in extent from N.E. to S.W., which they placed in lat. 35° 50′ N., and lon., by observation, 59° 46′ 38″ West of Cadiz, or 66° 4′ 11″ West of Greenwich.

POTOMAC'S SOUNDINGS, lat. 38° 10′, lon. 67° 26′.

On the southern side of the Gulf Stream, in the situation given above, soundings at 90 fathoms were found by Captain Smith, in the ship *Potomac*, of Alexandria, U.S., June, 1838, as shown in the chart.

DYET ROCKS, to the Eastward of the BERMUDAS?

Different charts of the Atlantic exhibit rocks at about 100 leagues to the East of the Bermudas, upon the authority, it is probable, of Bellin, who has stated, that "about 100 leagues to the East of Bermudas there is a little shelf of brittle rocks, which has been seen by one Louis Duhal, in a corsair, or privateer, that sailed around them; and as this shelf is nearly on the parallel of the Bermudas, many have mistaken it for the rocks about those islands." M. Bellin has observed that there are some rocks on this shelf whose tops are above the water; but that may doubt their existence.

We have subsequently made inquiry as to these vigias, and have been consequently informed, that rocks, *supposed* to have been seen by the late Captain Bell, of the *Francis Freeling* packet, were placed in about 33° 45′ N., and 55° 25′ W. The late Captain Hurd, who surveyed the Bermudas, assured us, that he did not believe the rocks to exist in the position assigned: and he supposed that some who had advanced, by error, too near the reefs to the eastward, or north-eastward, of the Bermudas, mistook them for rocks at a much greater distance from land.

The report of these rocks has been recently revived, by the following statement, which, with the former, will render their existence probable:—

"On my passage from St. Kitt's to London, and when off Bermuda, May 17th, eight a.m., we passed within 30 or 40 feet of two sunken rocks, having 6 or 8 feet water over them, it being very smooth at the time, in lat. 32° 46′ N. at-noon, lon. 60° 6′ W., by a good chronometer, and by several lunar observations previously. I strongly suspect they are the rocks marked as doubtful in lat. 32° 30′, lon. 59° W."—*Robert Dyet*, master of the bark *Catherine Green*, of London.—*Nautical Magazine*, August, 1845, p. 437.

A rocky bank, lying to the S.W. of the Bermudas, has been already noticed on p. 474.

ASHTON ROCK, between the BERMUDAS and CAPE HATTERAS?

Ship *William Ashton*, Captain H. B. Guy, 22nd May, 1824:—"At 11ʰ 50′, the man at the wheel saw *something* on the starboard bow, distant about 1 mile. Hauled the ship toward it, when we discovered it to be a rock; passed to the westward of it, at the distance of about 2 cables' length. The base of the rock appeared to be about 100 yards in circumference, on which the sea broke. In the centre was a point of rock in the form of a sugar-loaf, about 8 feet above the water, with a quantity of weed about it. [*Something like a whale?*] Passed the lead forward; no ground at 80 fathoms. Blowing fresh, too much sea to lower the boat down.

"Latitude, by a good observation, 33° 48′ 50″; longitude, inferred from lunar, 21st of May, at 19ʰ 31′, 71° 41′ 20″. The rock bore from us, at noon, S. 41° W., seven-tenths of a mile."

This has been considered as a very doubtful danger; whether the following will at all clear the doubt, we must leave for time to determine:—

"*Orion Rock, no soundings.*—We have received the following communication from Liverpool. The master of the *Orion*, belonging to our port, Luytjas, from Trinidad de Cuba, arrived in the Weser, has furnished the following particulars of a rock fallen in with:—On my voyage from Trinidad de Cuba for Bremen we perceived, May 5th, lat. 34° 51′ N., lon. 72° 28′ W., a rock about 2 feet above the water. It had the appearance of a water cask or two or three hogsheads. We were at a distance of only 20 feet from the rock, when we, fortunately in time, discovered it. On none of my sea charts (and I had several of the most recent on board) was this rock to be found.—*Bremen*, July 17th."—*Nautical Magazine*, August, 1845.

HUNTLY'S ROCK, lat. 30° 49′ 15″, lon. 78° 27′ 30″?

This danger (*if a danger*) was first made known by the following communication, addressed to Lloyd's, by Captain C. Huntly, in 1834:—

"I sailed from Balize (Honduras) on the 17th of November, 1833; and on the 30th of November, at about 8ʰ 40′ a.m., saw something on the lee bow; and at about 9ʰ came abreast of it. I, with the rest of the officers and passengers, saw distinctly that it was a

coral rock. We were about 60 yards to the southward of it. I immediately hove the ship to, and lowered down the quarter boat. Unfortunately, the boat swamped, and, with some difficulty, I got the chief mate and boat's crew on board again. I got some very good sights by an excellent achromatic, and by a very good observation at noon, and by reducing the ship's run, I find, that this rock lies in lat. 30° 49′ 15″, lon. 78° 27′ 30″ West from Greenwich. It was about 8 feet above the water, and in the fall of the sea it branched out to the N.N.W. about 30 feet in distance."

[*If a rock really exists here, it must be on the eastern border of the Gulf Stream, and on the parallel of St. Mary's River. It has not been inserted in the chart.*]

IMAGINARY SHOALS between 30° and 40°.

The *Steen-ground* to the westward of Madeira, and a *Vigia* to the S.W. of *Flores*, represented in 37° 50′ N., and 34° 18′ W.

BETWEEN THE LATITUDES OF 20 AND 30 DEGREES.

GOMBAUD'S ROCK, in lat. 23° 15, lon. 32° 25′ ?

According to M. Fleurieu, this danger was first seen in 1764, having been discovered by Gombaud, the commander of a merchant-vessel of Rochelle. Upon this authority, *and this alone*, it has been continued, and its existence is, therefore, doubtful.

OVERFALLS, or HEAVY RIPPLES, in lat. 24° 11′, lon. 61° 44′.

"On Saturday, the 7th of February, 1819, at ten a.m., the schooner *Brilliant*, Captain Tulloch, on her passage from Gibraltar to Havana, passed through very heavy overfalls, extending N.N.E. ½ E. and S.S.W. ½ W., *true*, as far as the eye could reach, with much sea-weed (*fucus natans*) in it. The breadth of the overfalls did not exceed half a mile. Course run from ten a.m., W. by N. 6 miles an hour, equal to 12 miles. Latitude, observed at noon, 24° 10′ 38″. Hence the latitude, in which we crossed the overfalls, was about 24° 11′ 11″, after allowing 1° 45′ S. for heave of the sea. The longitude of the overfalls, I found, by mean of three sets of lunars, stars Regulus and Aldebaran, East and West of the moon, continued to noon, by account, was 61° 43′ 57″ W." The preceding information was communicated by our friend Captain Livingston, by whom the lunar distances were taken. He adds, "None of us saw such a heavy ripple, except near land, before; and both Captain Tulloch and I felt confident that if there had been a fresh breeze, the overfalls would have broken very heavily. We saw no danger, but both suspect some one exists hereabout, and there was a good deal of gulf-weed about the edges of the ripples."

GANDARIA ROCKS, lat. 25° 30′, lon. 37° 45′.

The following notice of these rocks appeared in the Gaçeta de Madrid, May 28th, 1842:—"On Monday, April 18th, *Captain Gandaria*, of the Spanish merchant ship *Dolores Ugarte*, 107 days from Guayaquil, saw from the deck of that vessel a group of rocks about a cable's length in extent, and in the middle of them a large one, high and insulated, on which the sea broke violently. The latitude at the time they were seen was 25° 29′ 55″, and longitude, by chronometer, 37° 18′. The latitude observed at noon was 25° 40′ 45″, and lon. 37° 49′ 32″ W. of Greenwich, the vessel being at that time about 4 miles from the rocks. The observations for position may be depended on.

MOURAND'S BANK, in lat. 24° 34′, lon. 65° 10′ ?

This danger was dicovered by Mourand, commander of the *Prince de Nizarre*, of Nantes, on the 6th of April, 1773. This person has the character of having been an intelligent navigator and accurate observer. He describes it to be a "bank of red sand, many parts of which are out of water, like detached islands, over which the sea breaks; it appeared to extend about a quarter of a league from North to South." The journal of Captain Mourand's voyage having been submitted to the consideration of Messrs. Verdon, Borda, and Pingré, they have been enabled to calculate, with every probability of correctness, its true position.

DEEP SOUNDINGS S.E. of BERMUDA.

The *New Bedford Mercury* relates an account of some soundings obtained in the ship *Chaucer*, in April, 1850, as follows:—"Here, in lat. 27° 10′ N., lon. 62° 45′ W., on the

20th April, 1850, the nearest land being Bermudas, bearing N.W. by N., and distant 345 miles, water blue, with much gulf-weed, weather calm, no current, the boat was lowered; let run the lead, and got bottom in 744 fathoms. April 15th, lat. 27° 31′ N., lon. 60° 3′ W., Bermudas N.W. by N., 300 miles, sounded and got bottom in 366 fathoms. April 29th, lat. 29° 20′ N., lon. 64° 11′ W., Bermudas N. by W. 160 miles, sounded and got bottom in 620 fathoms.

The time occupied in running out the line varied from twenty to thirty minutes. The line was constructed thus: first 100 fathoms, five parts of shoe thread; second, four parts; third, three parts; fourth, two parts; remainder single. The lead weighed about five pounds: the whole wound upon a light reel, and held by hand. In this process of obtaining soundings the lead is not to be hauled up."—(*Daily News*, *Aug.* 28, 1850). We have no means of authenticating this, but give it as we found it.

GUIGOU'S BANK, in lat. 20° 50′, lon. 66° 45′?

M. Bellin, in the Memoir of his Chart, of 1742, describes this to be a "rocky bank, about 45 leagues to the northward of Porto Rico, upon which a Dutch vessel was lost in 1701, and that it had also been seen by a French vessel." Another manuscript, in the Depôt de la Marine, confirms this account, and adds, "The commanders of both vessels declare, that a little island of sand appears on the middle of the bank, in lat. 21° 24′, and that the bank is 3 leagues in length. It also appears, from the deposition of Christopher Whipple, commander of the *Anna*, of Rhode Island, that he was wrecked on the 27th of November, 1733, upon a shelf, from 30 to 40 leagues to the northward of Porto Rico, which, there is little doubt, must be the same. In the Marine Depôt of Paris there is a manuscript, entitled, " Plan of the Shelf which was discovered by Captain Michael Guigou, of Seine, in Provence, on a Voyage from Cape François, in the ship *La Concorde*, February, 1688." On that plan, it is placed at 45 leagues to the northward of Porto Rico, somewhat nearer to the western than to the eastern end. It has been subsequently represented in different situations. That given above is the probable mean.

COURIER ROCK, off MATERNILLO REEF, lat. 27° 51′ N., lon. 78° 31′ W.?

We mention this supposed rock on the authority of a statement in the *Shipping Gazette*, of February 27th, 1849. The *Courier*, of Greenock, drawing 15 feet, William Thompson, commander, states that he rounded the Maternillo Reef at 2^h p.m., and, at 6^h 20′ p.m., struck on an unknown coral reef, on January 22nd, 1849, and, on tacking, found 3¼, 4, 5½, 7, and 10 fathoms, and no bottom at 16 fathoms. He did not have Captain Bennet's Chart, as it was not then published, but he considered that the Maternillo Reef was laid down too far South. In some remarks on it (*Nautical Magazine*, 1849, p. 214) it is argued that the courses would not bring the ship to the position, and that the eddy of the Gulf Stream would also tend to vitiate the reckoning. With these views it is then contended that a 2 fathoms coral spot, at the N.W. end of the reef, marked on the chart, is the *real* danger. We do not decide on this matter, but leave it to the reader. But in the *Nautical Magazine*, August, 1847, p. 421, there is a statement from Captain J. Watkin, commanding the ship *Joshua Waddington*, of Liverpool, that on May 13, 1847, he discovered and touched on a spot not larger than three or four times the size of the ship, with 3 fathoms, sand and clay, which was stirred up by the ship. It was supposed to be a detached part of the Maternillo Shoal, but no particulars of its position are given.

INGLEFIELD BANK, in lat. 29° 42′ N., lon. 80° 17′ W.

This bank, lying about 66 miles East of St. Augustin, was discovered by Captain S. Hood Inglefield, on the 26th of May, 1810, latitude 29° 42′ N., longitude, by account, 80° 12′; by chronometer, 80° 17′; and by lunars, 80° 18′. Sounded in 25 fathoms, black sand: hence, steering N. by W. ½ W., course made good, had regular soundings, 24, 25, and 27 fathoms, speckled sand and broken shells, until six p.m. on the 27th, when no bottom could be found. Noon, on the 27th, latitude 30° 5′ N., longitude, by account, 80° 25′ W., by chronometer, 80° 25′. On the 26th, the current set W.N.W. 1 mile an hour: at four p.m. on 27th, no current. On the 28th, in latitude 31° 5′, longitude, by chronometer, 79° 46′. Current ran N.N.E., 1½ miles an hour.—*Communicated by Lieutenant John Evans* (*a*), R.N.

VIGIAS BETWEEN THE EQUATOR AND THE PARALLEL OF 20 DEGREES.

HANNAH'S CORAL SHOAL, lat. 10° 7′, lon. 27° 32′.

This shoal was discovered by Captain Thomas Fanning, of the brig *Hannah*, on the passage from Rio Janeiro to Trieste, June 25, 1824. It appeared to extend 150 fathoms N.E. and S.W., with two branches or arms from it on the N.W. side, and one on the S.E. side. Sounded in 15 fathoms, granulated coral, on the S.W. part, but supposed it much shoaler on the N.E. points, as the weed was plainly to be seen from the mast-head on the surface of the water. Its latitude was found to be 10° 7′ N., and longitude about 27° 32′ W. The latter was deduced from lunar observations taken the day before; but as a strong westerly current [the Equatorial] was experienced, it cannot be depended on within 20 miles. The latitude may be considered correct.

MARIA ROCK, MADELINE REEF, WARLEY'S SHOAL, FRENCH SHOAL, BOUVET'S BANK, ETC.?

We have now the grateful task of introducing extracts from a letter addressed to the Secretary of the United States' Navy, by Lieutenant* *Chas. Wilkes*, commanding the South Sea surveying and exploring expedition, and dated on board the sloop *Vincennes*, at Rio Janeiro, November 27, 1838.

It will be presently seen that the squadron effected the examination of the supposed position of ten or eleven shoals or dangers, the detailed accounts of which were formerly given in this work, their assigned positions in the charts, and the non-existence of which has, apparently, been *proved*. The search, in the first instance, was for *St. Anne's Shoal*, long since expunged, and which, of course, was not found; but hereabout they fell in with a large cotton wood tree, 120 feet long, and 15 feet in circumference, which was, at first, reported as a shoal; and, with a rough sea, in passing, it might have been mistaken for one. Captain Wilkes says, "I have little doubt but similar trees have occasioned the frequent reports of vigias or shoals being in existence hereabout.† Our position, at this time, was in lat. 37° 0′ 37″ N., lon. 40° 41′ 54″ W., and where any floating bodies drifted by the Gulf Stream would, probably, have been deposited, as here is little or no current, and that variable.

"The first reported shoal laid down on our route upon the charts was the *Maria Rock*, in lat. 19° 45′ N., lon. 20° 50′ W., which we stood for, and hove-to near the position, until we had ascertained our position correctly, by careful observations. The vessels were then spread, and the course marked to run directly over the spot; the surface of the ocean, visible at the time from the squadron, was not less than 60 miles in circumference, with every opportunity which the clear weather could afford, and sufficient swell of the seas on to have caused breakers on any shoal within 15 feet of the surface. Nothing, however, was discovered, and no bottom could be found with 300 fathoms of line.

"The next position examined was *Bom Felix Shoal*, said to be within 30 miles of the Maria Rock; this we searched for in the same manner, but were equally unsuccessful. We then stood for the place assigned to the *Bonetta Shoal*, to the eastward of Bonavista, said to be in lat. 16° 32′ N., lon. 20° 37′ W. We, in like manner, hunted for this, and, after exploring the locality of its position on the chart, I steered on the course of its reported bearing, E. by N. from Bonavista, until nearly up with the *Hartwell Reef*, lying in sight of Bonavista, which has, without doubt, been taken for, and reported as, the shoal called *Bonetta*.‡

"Our inquiries at St. Iago assured me that the *Madeline* (the vessel last wrecked) was cast away on the Hartwell Reef, which has been reported as the Bonetta Shoal.

* Professionally styled "Lieutenant Commandant."

† A more remarkable instance is noticed in the description of the search for Aitkin's Rock, p. 442.

‡ Notwithstanding this search, we have an announcement (p. 522) of the discovery of a shoal *which, if it exists*, must be the Bonetta Rock, in lat. 16° 59′ N., lon. 21° 30′ W, or 30 miles from its originally assigned position, and might therefore be passed over by the U.S. squadron.

"I am well satisfied that the positions assigned to the above three shoals on the chart, and their vicinity, are free from all dangers. I am of opinion, also, that the particular and indefatigable search made by Captain Bartholomew, of H.M.S. *Leven*, and the opportunities afforded me of covering, with the squadron of five vessels, so large a space at the same time, ought to be sufficient evidence that no such dangers exist as they are laid down in those positions, and should cause them to be obliterated from the charts.

"From Port Praya we steered for *Patty's Overfalls*, as laid down in the chart, in lat. 11° N., lon. 24° 30′ W., and had a good opportunity of examining their locality. A few rips were observed within a degree of the situation assigned them, but little or no current was found; and I feel confident in asserting that no danger exists in this vicinity, as we were becalmed in the position, and in close proximity to it, for forty-eight hours, the squadron as usual being spread apart, and having a broad expanse of ocean under view. Owing to contrary winds it was some days before we reached *Warley's Shoal*, said to be in lat. 5° 4′ N., lon. 21° 25′ W. This point was also carefully examined, but no shoal, or appearance of shoal water, or any danger discovered.*

"Our next examination was of a *French Shoal*, said to be (as laid down) in lat. 4° 5′ N., lon. 20° 34′ W. This was also examined, and no danger or appearance of shoal discovered. From this point, I took advantage of the southerly wind, and proceeded East; which carried me as far as 13° of West longitude, and over the position assigned to the shoal by the French hydrographers, to enable me to cross the equator eastward of the 17th degree of West longitude. We succeeded in crossing the equator in that longitude on the 5th of November, and then stood for the *Triton's Bank*, said to be in lat. 0° 32′ S, lon. 17° 46′ W. When within a short distance of its position, the squadron hove-to, for the purpose of ascertaining our position accurately; after which, a course was steered nearly West. Being, at the time, well to the eastward, we ran on a line due East and West over it; the vessels of the squadron being spread about 3 miles apart, on a line North and South. We did not, however, find it in our progress, or any bottom or indication of soundings; no *discolouration* of water was visible, or change of temperature, although the line extended 30 miles East and West of its reported position; after which we again stood to the North, and ran over a *vigia* as laid down on the charts, but none such was found in existence.†

"Our next examination was for *Bouvet's Sandy Island*, which was, in like manner, carefully searched after in and around its position, as laid down in the charts, but our search was equally unsuccessful.

"Finally, search was made in and about lat. 2° 43′ S., and lon. 20° 35′ W.; extending to the N.N.W. of this point a distance of 30 miles hereabout having been assigned as the situation of the submarine volcano reported by Admiral Krusenstern, which, it was supposed, might have left a shoal. This locality was twice run over in different direc-

* On this shoal, *or imaginary shoal*, the following remarks were previously made by Captain George Cheveley. In sailing from Madeira toward Pernambuco, I observed exactly in the latitude and longitude assigned to this shoal; a good lunar observation, at the same time, differed only two minutes from two chronometers. I lowered my boat down, and pulled due West several miles, and then returned and pulled to the eastward, sounding occasionally. I am firmly convinced that no such shoal exists. I have myself fancied being in shoal water, when, upon examination, I have found the appearance to proceed from fish spawn, or from a peculiar change the water often assumes in a heated atmosphere. It would be well, upon *good* authority, to eradicate all *supposed* shoals and rocks from the charts; they tend only to alarm the young navigator. It may be said that they serve to make you careful; but there are real dangers enough for that purpose.

† Although the officers of the U.S. Expedition, by their researches, may have disproved the *present* existence of these shoals, it does not follow that they have all been reported without foundation; as, for example, the Triton Bank: its discoverer found 23 fathoms and *brown sand* on it in 1816. In the Warley Shoal, the bottom was distinctly seen; Bouvet's Sandy Island was seen in 1761; and others, of which the circumstances do not appear to admit of any doubt. We may, nevertheless, rest nearly assured that they present no danger in the present day. In the *Ethiopic or South Atlantic Directory* will be found a list of phenomena that have been met with in the neighbourhood of the equator and longitudes 17° and 21° W., which seem clearly to indicate that a range of volcanoes, or an upheaving of the bed of the ocean in that part, is now in action, and the various reports that have arisen have had their origin from this cause. A portion of the above-mentioned shoals is included in this space; and, therefore, we beg to refer the reader to that work for a more full description of these singular phenomena.

tions, and carefully examined, with the squadron in open order, but none such was found in existence.

"Lieutenant Hudson, of the *Peacock*, having separated from me on the 16th of October, proceeded on a different course in search of the same shoals which we were looking for, but was unsuccessful in finding any, as appears by the following extract from his report to me, which affords further evidence, if it were needed, of their non-existence:—

"'Having separated from you on the 16th of October, it was not until the 23rd that I had worked up to the *Warley's Shoal;* and at eight o'clock that night I was directly on the spot where it was laid down on the chart. We placed good look-outs, and kept our patent lead going for 50 miles before reaching the location of this shoal as laid down on the chart; also observing our drift at night, in hope of sweeping over it at early daylight. I continued cruising in this vicinity, in various directions, getting casts of lead in from 50 to 100 fathoms, without finding bottom. I now continued my examination, and after having swept over a circle of 40 or 50 miles in different directions, am perfectly satisfied that Warley's Shoal exists nowhere in the neighbourhood laid down on the chart.

"'I then proceeded for the *French Shoal*, with the wind ahead (S. by W.), where I arrived on the 25th of October, and continued cruising all the following day, with a fine breeze, immediately over the location of the shoal as laid down, and in every direction for miles in its vicinity. After thus thoroughly searching the *English* locality of this shoal, I directed my course for the French position, 76 miles distant, making nearly an East course, with look-outs and the lead going, until I had run immediately over and around the spot, sailing in various directions a distance of 40 miles, without effect.

"'I then made the best of my way for the *Triton Bank*, with the wind veering and hauling from S.S.W. to S.S.E., and passed the equator on the night of the 3rd of November, in lon. 17° 40′ W.; and continued over and around the locality of that bank until the morning of the 5th, getting casts of the lead during the time in from 50 to 250 fathoms, up and down, without finding bottom. I have, in our search, fully satisfied myself, and hope our examination will prove equally so to you and all others, that these shoals do not exist.'"

To the imaginary shoals above mentioned, we may doubtless add *Dubreuil's Vigia*, lat. 14° 50′, lon. 29° 40′; *Vigia de 5 Palmas*, lat. 12° 0′, lon. 27° 20′; *Longchamps Rock*, lat. 9° 47′, lon. 30°; and the *Maalstrom*, in about 16° N., and 37° W.

BONETTA, or EMILY ROCK, lat. 16° 59′ N., lon. 21° 30′ W.?

We give, as we are bound to do, the following account, as detailed in the Supplement to the *Globe* newspaper, Tuesday, September 30th, 1845. "A letter, received at Lloyd's from the master of the brig *Emily*, of London, reports that they had discovered a rock and shoal in lat. 16° 59′ N., lon. 21° 30′ W., of which no mention is made in modern charts.

"The rock is about *two* feet above the level of the sea, about 12 yards long, of an oblong form, and of a gray colour. The shoal extended from the rock about two cables and a half in length and one in breadth, running due East. The latitude and longitude were obtained by good observations at noon."

This appears circumstantial; and it has not been got up to account for any disaster, a plan which has given rise to the very extended discussion on this very Bonetta Rock, as alluded to on page 454.

Respecting the authenticity of this report we have no guarantee but the above. It was certainly believed by many men, whose opinions deserved attention, that the Bonetta Rocks did exist; but the examinations of Captains Vidal, 1838, Bartholomew, 1819, and Wilkes, in 1838, were considered satisfactory as to its non-existence, and it has been accordingly expunged. But Captain Vidal's single track towards the reported position of the rock does not pass within 17 or 18 miles of the position given above. Nor did the United States' squadron search for it in the position originally assigned, lat. 16° 32′ N., lon. 20° 37′ W., within 30 miles of that now given; nor was it passed over by Captain Bartholomew in 1819.

Now from the character given of this rock, a low rock only 36 feet long and *two* feet out of the water, with an attached shoal, it is possible that it may have eluded the vigilance of many who have passed *near* it. *If it does exist*, it is a serious danger; but on this point we will say what Mr. Purdy did of it—we cannot pretend to decide on this subject.

PEÑEDO DE ST. PEDRO, otherwise called ST. PAUL'S ISLETS.

A cluster of five steep craggy rocks, without verdure, covered with birds' dung, and having no place fit for anchoring, or convenient for landing. They are about a quarter of a mile in extent each way, and the highest part is about 100 feet above the sea. With a line of 100 fathoms, no bottom was found within 2 miles of the islets. The appearance annexed has been communicated by the intelligent master of a merchant ship.

The rocks change materially in their appearance, according to their bearing. The *Tellicherry*, East Indiaman, passed in sight in 1802, and found that the appearance, between N. 30° W. and N. 37° W., 6 or 7 miles distant, was that of a heap of rugged rocks, with low gaps between some of them. The northernmost, a small pyramidal rock, rather lower than the rest.

Penedo de St. Pedro, West, 6 miles, as taken by Captain Monteath.

From observations made in the *Thames*, in 1798, compared with those made in several other ships, it is inferred that the position is lat. 0° 55′ 30″ N., and lon. 29° 19′.

Commodore Brou, of the French frigate *Hermione*, in 1825, describes Peñedo de San Pedro as a mile in extent, in a N.E. and S.W. direction; seen in fine weather 4 or 5 leagues off; when bearing N.W. appearing in the form of three pinnacles of sharp naked rocks of a remarkable shape. The S.W. pinnacle separated a short distance from the others. The latter appears safe to approach, and no breakers were seen, to indicate sunken rocks. The *Hermione* sailed round on the eastern side at the distance of 5 miles; did not try for soundings, but from the colour of the water it was presumed that bottom would not be found.

The Equatorial current set the ship to the westward at the mean rate of 18 miles, and to the North 6 miles, in the twenty-four hours, between the parallel of 8° N. and the equator, and the meridians of 28° and 30° W. At the islets the direction of the current changed, and set more to the northward, at three-quarters of a mile in the hour.

The best description of these isles is that of Captain Amasa Delano, who, in the American ship *Perseverance*, from Boston toward Cape Horn, 23rd December, 1799, at two p.m. saw three small islands bearing W. by S., 2 or 3 leagues distant. The vessel bore away, and at three p.m. was abreast of them. Hoisted the small boat out, went on shore, and found them to be nothing more than a cluster of craggy rocks, about one-fourth of a mile in extent from North to South, and nearly as much from East to West. No sort of vegetation existed upon them. The rocks were found to be five in number, but only two of any considerable magnitude. Their greatest extent was from N.N.E. to S.S.W. The two largest nearly connect with each other, and form a kind of harbour, or place of shelter for a boat, on the N.W. side. Here they managed to land, but obtained nothing except a number of boobies. On shore the aspect was most dreary, the sea roaring and surging on all sides. Two smaller rocks were lying off to the S.S.W. of the large ones, and one, very small, to the N.E. When on the highest part, which was at least 100 feet above the surface of the sea, no dangers could be seen but what showed themselves above water; nor could any be discovered from the ship. Plenty of fish were caught in the harbour or basin. At six p.m., returned on board. Sharks were numerous about the ship, but in attempting to take them, a number of hooks and lines were lost, and several pairs of grannes broken. On sounding, within 2 miles of the islets, no ground could be found with a line of 200 fathoms.

Captain Delano states that the islets may be seen at the distance of 4 leagues, and always make like three sail when first seen. They are very dangerous if fallen in with by night. The current near them set N.W. by N., *true*, 1 mile an hour. The parts above the reach of the surf are covered with birds' dung. The birds were hatching their young at the time. The month of November would be the season for procuring eggs at

this place, as they may be obtained at that time in abundance; but being the eggs of oceanic birds, they are rather fishy than sweet. We have seen a different latitude assigned to the rocks, but consider it as incorrect.*

Captain Fitz Roy, from his observations, places the summit of the Peñedo in lat. 0° 55′ 30″, lon. 29° 22′. The variation here, on the 16th of February, 1832, was 9½° W. Temperature of the air and water, 82°. Wind, S.E. The rocks were seen on the horizon at sunset of the 15th. They appeared extremely small at about 8 miles distant. At daylight next morning two boats were sent to land upon and examine them, while the *Beagle* sailed round, sounding and taking angles. Good observations were made during the day, as the sky was clear and the water smooth.

The multitude of birds which covered the rocks was astonishing, and they suffered themselves to be kicked about and killed with sticks; at the same time, those on the wing even darkened the sky. While one party were scrambling over the rock, a determined struggle was going on in the water, between the boats' crews and sharks. Numbers of fine fish, like the groupars (or garoupas) of the Bermuda Islands, bit eagerly at baited hooks put overboard by the men; but so soon as a fish was caught, a rush of voracious sharks was made at him, and, notwithstanding blows of oars and boathooks, the ravenous monsters could not be deterred from seizing and taking away more than half the fish that were hooked.

At short intervals the men beat the water with their oars all round the boats, in order to drive away the sharks; and, for a few minutes afterward, the groupars swarmed about the baited hooks, and were caught as fast as the lines could be hauled up,—then another rush of sharks drove them away; those just caught were snatched off the hooks; and again the men were obliged to beat the water. When the boats returned, they were deeply laden with birds and fish, both welcome to those who had been living on salted provisions.

"From the highest point of the rocks, which is 64 feet above the sea, no discoloured water, nor any breaking of the sea could be discerned, apart from the place itself; and from the soundings taken in the boats, as well as on board the ship, I conclude that it is unconnected with any shoal, being merely the summit of a steep-sided mountain rising from the bottom of the ocean. A slight current was setting to the westward, not amounting to a mile an hour."—(Vol. ii., p. 56.)

CÆSAR BREAKERS, in lat. 3° 7′ N., lon. 24° 14′ W.

In the early editions of this work this danger was included among those which threatened the navigator; but from its not having been seen of late, it has been classed among the imaginary shoals. It is stated on the chart of M. de la Rochette to have been seen, in 1730, in lat. 2° N., lon. 22° 18′; and on this authority it held its place, but was considered as very doubtful.

It has been again revived, by a not very clear account of it, as follows:—"On the night of the 4th of July, 1846, at 7ʰ p.m., ship running 6 knots, saw breakers on the larboard bow, distance a quarter of a mile, strong current setting towards them; wore ship and stood along them; when first seen they bore by compass N.W. by N., and seemed to be a long ledge of rocks in a crescent shape; at 3ʰ a.m., the following morning saw the S.E. end of the reef on the starboard bow; a strong breeze coming on prevented us making any farther examination; the man, in heaving the lead, ***struck it upon a hard rock*** (no depth nor situation stated), but had no bottom the second cast.

"There can be no doubt of the existence of this reef; and so convinced were the crew, that they stood ready to clear away the long-boat; neither was it any optical delusion from effect of current or phosphorescence of the sea. As they are in the longitude of vessels crossing the equator, it is surprising they have not been reported; by good sight at noon, with chronometer and distance run, their position, when seen, was lat. 3° 7′ N., lon. 24° 14′ W."—(*Charles Pryce*, supercargo, brig *Mary*, from Africa to Liverpool.)†

The above account seems circumstantial, but it is to be regretted that their depth and their extent are not stated. The latter appears to be considerable; as the ship stood by them for eight hours with a 6 knot breeze. They are also 145 miles from the previously assigned position of the Cæsar Breakers, but the early dates of the first announcement

* The late Captain Henry Forster gave the position as 0° 58′ N., and 29° 16′ 40″ W.
† Nautical Magazine, November, 1846, p. 613.

will allow great variation in position. It may be a volcanic shoal or range of rocks, which, gradually upheaving or subsiding, may come to the surface, or sink low enough to remove all visible indications of its existence.

BLAESDALE'S REEFS, in about lat. 0° 57′ N., lon. 41° 6′ W.

On the 15th of October, 1819, the brig *Richard*, of Ulverston, Captain Blaesdale, struck on a coral reef, in about 0° 56′ or 0° 57′ N., lon., by *account*, beyond 41° W. In fine moderate weather, the ship going at the rate of 3 knots, at 6ʰ p.m. grounded, and remained fast about ten minutes. The water was smooth, and no breakers seen. Upon sounding, a few minutes after, no bottom could be found at 150 fathoms. The vessel drew 11 feet of water, and in 1 hour there were 18 inches of water in the well. On a subsequent survey at Para three holes were found, each about the size of a man's hat, and nearly through the vessel's bottom, and several large pieces of white coral, as large as a man's hand, were found sticking in different parts.

THE INDIA SHOAL, West of CAPE VERDE ISLANDS?

This shoal is laid down from the chart of M. Rochette, 1777, on which it is stated to be mentioned in several journals of East India ships, and to lie 70 leagues W. by N., *true*, from St. Iago. We are unacquainted with the nature of the danger, but have placed it as it before appeared. Its position may be considered as *very uncertain*.

BAXO DAS GARCAS, lat. 12° 30′ N., lon. 29° 2′ W.

Upon the authority of the old Dutch chart by Vankeulen, "which is but one shade better than no authority at all," a bank was inserted at 107 leagues W.S.W., true, from Brava, or in lat. 13° 0′ N., lon. 29° 50′ W. This has been omitted in former editions, but the following revives it.

(Translation.)—On Jan. 17th and 18th, 1848, on board H.M.F.M. brig *Villa Flor*, Lieutenant Commandant P.V.C. Louveiro e Pinho, on her way from Loanda to Lisbon, wind N.N.E., N.E., fresh and steady.

At 3ʰ 30′, p.m. on the 17th, the men on the watch reported that a breaking of the sea was seen to leeward on the bow, and I and other officers having got up to the foremast cross-trees, saw beyond all doubt that it was a shoal, which we marked W. ¼ N.W. (or W. by N.) by compass at 6′ distance; the ship being then to the eastward of it, and having taken the ship's reckoning to that hour, it was found that her position at 3ʰ was lat. 12° 30′ N., by 28° 56′ W.; the longitude being determined by a very correct chronometer, and the latitude by observation, deducting the ship's course up to 3ʰ 30′, p.m., when the shoal was seen.

From the observations taken at noon on the 18th, and from the course followed, the ship ought to have passed over the shoal called the Garia or Garças. It was not, however, seen, which shows that the real Garças was that seen on the 17th.—*Nautical Magazine*, May, 1848, p. 258.

PORGAS BANK, between the Cape Verde Islands and the African coast.

In the early charts of the Atlantic this bank has always been shown, as extending 50 leagues in length N. and S., with a breadth of 5 leagues. Nothing more than this appeared to be known of it except the statement that it was all deep water, and not dangerous to shipping.—(*Oriental Navigator*, p. 27.) It was unsuccessfully sought for by the *Leven* in 1819. In some later charts it has been omitted for want of some confirmation, but this seems to be revived by a cast of the lead taken in the *Birkenhead* steamer, in her voyage to Ascension, under the command of Mr. J. B. Aylen, R.N., on Nov. 11th, 1850.

The position, carefully deduced from chronometer and observation, is 17° 0′ N., lon. 20° 3′ 15″ W., and the depth 86 fathoms. The bottom appeared to consist of pieces of shells and sand, or small particles of coral. Mr. Aylen says that "I did not like heaving the ship to, to take another cast, particularly as I considered myself on the edge of the bank only, and that at noon, when on its centre, I would again try, which I did without success, with 90 fathoms of line.—(*Nautical Magazine*, 1851, p. 155.)

TEXEIRO'S SHOAL, in lat. 12° 0′, lon. 33° 28′?

Breakers seen by Don Angel Texeiro, Captain in the Spanish navy, April 16, 1810, from the American ship *Topacio*, bound for Boston. They appeared to extend about a

mile from North to South, and 2 cables' length from East to West; latitude, by observation, 12° 0′ N., lon. 33° 28′, from lunars 3 days before.

Volcanic Region.

Galleon's Bank, in lat. 15° 56′, lon. 49° 40′.

This supposed bank, or reef of rocks, was discovered on the 23rd of July, 1730, by Longueville, the pilot of the *San Fernando*, commanded by M. de Navaro, Admiral of the Spanish galleons. By the detail into which Longueville enters, concerning this danger (his journal being in the Depôt de la Marine at Paris), there can be no doubt of the fact. It appears that the *San Fernando*, apparently struck on and passed over it, without receiving any damage. Other ships in the same fleet also struck, with more or less violence, but without actual injury. In the Depôt de la Marine there is also a memorandum of the existence of a bank in 15° North latitude, and 228 leagues East of Martinique, upon which there is said to be 40 fathoms of water, bottom of fine sand: and over which Joachim Voette is said to have passed and sounded. Who this Joachim Voette was is not mentioned, nor when he ascertained its position. If, however, this last-mentioned bank really exists, it may be the same as that over which the Spanish galleons passed.

M. de Humboldt has noticed, that there exists in the parallel of the island Dominica, and very near the 55th degree of longitude, a space wherein the water seems *constantly milky*, although the sea is very deep: and he asks, "May there not be, in this place, some sunken volcanic islet?"

This last question will perhaps afford a clue to the true nature of these observations. In our "Memoir for Ethiopic, or South Atlantic Ocean, in describing a region just South of the Equator, within which very numerous evidences of volcanic action have been met with, and are there first collected together, we have shown that the shock caused by an eruption under water is transmitted through the water to very great distances, and its effects on any ship it may reach in passing is precisely similar to that of striking on rocks, and consequently several announcements have been made that an actual rock had been touched, but of which no other evidence than the shock could be discovered. Referring to the present point, we have a notice issued by Lieutenant Maury, of the National Observatory at Washington. Captain Ballaird, of the ship *Rambler*, from Calcutta, on October 30th, 1850, in lat. 16° 30′ N., lon. 54° 30′ W., and Captain Potter, of the bark *Millwood*, last from Rio, half an hour later on the same day, when in lat. 23° 30′ N., lon. 58° W., each felt a volcanic shock. These vessels were about 520 miles apart. Supposing them to be in direct line, in which the earthquake was travelling, its rate will appear to be about 1 mile in 5 seconds, which is only a little slower than sound travels through the air.

With this knowledge and the announcements following, of the *Betsey's Rock*, *Galissionère's Rock*, *Martin's Reef*, *St. Esprit Reef*, and the singular phenomena related by Churruca, Greevelink, and Nockells, it may be inferred that a large extent of ocean, running parallel with the range of the Windward Islands, covers either a range of submarine volcanoes, or that the bed is in a state of action from the same cause.

Discoloured Water and Soundings.

At 3 p.m., on the 15th of July, 1792, Don Cosme de Churruca, then on his passage to the West Indies, discovered a boiling and breaking of the sea, so very extraordinary, that it appeared to be breakers; but they found no bottom at 150 fathoms. This phenomenon, which appeared to be in consequence of a current setting against the wind, accounts for the differences between the observations and dead reckoning.

On the 16th, at 10 a.m., they were in lat. 13° 56′, lon. 54° 7′ West of Greenwich; and observed that the colour of the water changed, looking like muddy river water, or as if they were on a bank. They were 128 leagues to the eastward of the middle of St. Lucia, and 150 to the N.E. of the mouth of the Orinoco. They continued their course without alteration; sounded at night, and found no bottom at 120 fathoms. The captain, Churruca, says, that the colour is always the same in that part of the ocean, always appearing as if on soundings in that latitude and longitude, and that it never varies the position of its limits: and, in addition to his own remarks, he had assured himself of the fact by information collected from various sources; and that, also, the English sailing directions for the year 1782, entitled the *Complete Pilot for the Leeward Islands*, in the

account of Barbadoes, mentions, that this phenomenon is found at the distance of 70 or 80 leagues to the eastward of that island, and that there are no soundings, though the water seems as if there were.*

The passage above quoted, from the old Book of Directions, is as follows:—

"In the latitude of Barbadoes, about 70 or 80 leagues to the eastward, you will find the water discoloured and prodigiously thick, as if there were soundings; but there are none, and you may depend on being at the distance aforesaid from the island." †

"In alluding to Mr. Luccock's remark about the patches of water which exhibit a brown and dirty appearance, and also to the note from Captain Kotzebue in the *New Sailing Directory for the Ethiopic*, page 39, I should question, with all deference, whether the depth of water in such places was tried to a sufficient degree of certainty.

"On our passage from the West Indies to Europe in July, 1837, at about four in the afternoon of the 7th, a streak was observed on the surface of the sea, exactly in the same manner as Captain K. describes, and at the moment we passed over it the lead was hove in a very proper manner without finding bottom; but, having lowered the boat, soundings were found to exist, although in more than 30 fathoms of water. The latitude computed from observations, taken at noon, was 21° 12′ N., and longitude, by chronometer, 58° 42′ W. —*A. H. Bisschop Greevelink.*"

Off the coast of Guyana, in the morning of the 17th of September, 1835, on the track of the *Echo* from Antigua toward Surinam, there appeared at about seven o'clock, in every direction upon the surface of the ocean, several large spots of discoloured water, more or less thickly mingled, as it seemed, with mud. It was a fine morning, the sun rose in all its splendour, and not a single cloud was there to throw its shade upon the water, which was uncommonly smooth, although the ship ran 6 miles an hour; besides the water in some of the spots was so thick as to make the blue waves curl against their edges. Having, says M. Greevelink, the watch at the time, I gave warning of this strange occurrence to our captain (the late and much-lamented W. H. van Voss), who came on deck and ordered me to keep, not to alter, our course, by which we passed through two of those spots, yet we did not heave the lead, as it was the first day in which we gained a breeze, after fourteen days struggling with horrible calm and rainy weather, and two-thirds of our crew confined to their hammocks.

While in the midst of these spots I observed the latitude by the moon, then passing the meridian, 11° 47′, and the longitude, by chronometers, and at the same time by lunar distances, three excellent sets, 53° 47′. In about three-quarters of an hour we were clear of them, and the sea resumed its former clearness. The current, Equatorial, for several days remained northerly, yet was not very strong.

That we had not been in soundings we felt nearly convinced by existing circumstances; yet how came this muddy water here? The common discoloured water of Barbadoes it was not, as the latter is a large extent of water, of a different, but somewhat lighter hue than that of the ocean, at least, so far as we have seen it. As for my humble opinion, I seek for a cause of this appearance only in the force with which the Marañon rushes downward, but without sufficient power to strengthen the Equatorial current. This may seem contradictory, but I think it may be found reconcileable in the manner following:—

This river impetuously pours forth its waters in a mass over a bed of some declivity, which steepens more and more towards its issue till it becomes a precipice, so as to form a cataract, whereby a part of its stream may dive beneath the stratum of undulations of the ocean, and afterward rise to the surface by its lesser specific gravity; where, driven still farther off by the northerly current, it may easily remain for some days in the above-mentioned manner, especially in those months wherein continual calms prevail, and the water is rarely disturbed by the wind. (This may be the case, but it may also be attributed to a volcanic origin as stated above.)

* It seems that the appearance of soundings described above occurs in the same place where Captain Tulloch told me a bank existed, which some Americans were in the habit of making, as a fresh point of departure when bound to Surinam, &c.—*A. L.*

† In 1813, at the distance of 197 miles to the eastward of Barbadoes, we found the water discoloured: the thermometer rose here 1°. The current [Equatorial] inclines to the northward here; which, as well as the discoloured water, may be attributed to the stream discharged by the great River Orinoco, &c.—*Lieutenant Evans.*

BETSEY'S ROCK, in lat. 18° 7′, lon. 50° 0′?

This is described as a flat rock, seen by the brig *Betsy*, on her passage from Greenock to Jamaica, 17th of September, 1808. The captain of H.M.S. *Dædalus* spoke the brig off Port Morant, 9th of October, 1808, and received this information from the master and passengers.

GALISSIONIÈRE'S ROCK, about 12° 20′ N., and 54° 49′ W.?

This vigia was exhibited, on the chart of M. Rochette, as a rock, mentioned by M. Galissionière, and some other navigators. A spot, nearly in the same situation, had previously been called the *Isle of Fonseca*. It is said to have been seen by the *Rainbow*, man-of-war. We have been lately informed, though vaguely, that the rock was again seen in 1822.

MARTIN'S REEF, eastward of GUADADOUPE, in 16° 42′ N., and 58° 53′ W.

A shoal was inserted hereabout on the chart of Bellin, 1742, who says that it is mentioned by many navigators. "It was again seen in July, 1816, by Captain Martin, of the ship *John Manning*. The shoal seemed to consist of yellow sand, with sea-weed upon it: to be about half a mile in length from East to West, and a quarter of a mile in breadth from North to South."

We have been informed, on respectable authority, that this reef was again seen by the ship *Cecilia*, of Glasgow, 19th July, 1823, by which the position assigned was, 16° 44′ N., and 58° 50′ W. To the commander of the ship it appeared to be about 1¼ or 2 miles long, and only about 30 feet wide: the western part, shaped like the bulb of a thermometer, seemed dangerous.

Lastly, Captain Newbold, of the brig *Transit*, on her passage from Halifax to St. Vincent, in February, 1842, discovered a shoal to windward of the Island of Antigua, in lat. 16° 42′ N., lon. 59° 6′. He examined it as carefully as circumstances would permit, and describes it to be about 200 feet long, and 80 feet wide, with 3 fathoms water in the centre, and much shallower on the edges.

The mean of these three positions is given above.

DELAWARE SHOAL, eastward of TRINIDAD.

Captain Ross, in the brigantine *Delaware*, from Charleston, on the 16th September, 1839, at noon, in lat. 10° 38′, struck soundings in 37 fathoms, shells and sandy bottom. At three *p.m.*, steering South, passed over a rocky bank, having 5, 7, and 10 fathoms, and bottom plainly seen; inferred from the distance run that the latitude of the shallow part of the bank must lie in 10° 37′ N., longitude, by chronometer, 60° 3′ W. At a quarter past three *p.m.* had 70 fathoms of water.

ST. ESPRIT REEF, in lat. 14° 37′, lon. 58° 59′?

The following is a copy of a notice published in the London Daily Papers of October, 1817:—"On the 4th of July, 1817, the French ship *St. Esprit*, bound from Marseille to Martinique, in lat. 14° 37′, lon. 64° 18′, 35 leagues distant from the island, fell in with a chain of rocks, about 8 feet under water, extending about 500 fathoms from North to South, and being about 100 fathoms broad, and were plainly seen on the bottom from the vessel. According to a sketch given of the reef by the Captain, it lies somewhat in the form of a half-moon; and the ship, running westwardly with a strong wind, got within its horns, and narrowly escaped being wrecked, but made her way out by the South point. The reef, it seems, from its situation, must have been of recent formation, as it is in the track of vessels bound to Martinique, and is not known to have been before observed."

It was announced, in the year 1833, that H.M.S. *North Star*, on the 11th of February, while on her way from Antigua to Demerary, under the command of Lord William Paget, struck soundings in 7 fathoms, near the position assigned to the Esprit Reef; and, in consequence of this, Vice-Admiral Sir George Cockburn, commander-in-chief on the station, directed the ships of his squadron to search for the danger; these were the *Ariadne*, *Sapphire*, *Vestal*, *Forte*, and *Victor*, in January, 1834, and *Galatea*, in 1826; but, after a vigilant search, neither reef nor shoal have been found.—(See *Nautical Magazine*, November, 1834.) Again, on the 11th of October, 1833, H.M.S. *Dispatch*,

Captain Daniells, passed over or near the place where the *North Star* struck soundings; the lead was kept going for six hours, without any indication of shoal water. It is, therefore, clear that the true situation of the danger has not been ascertained.

CLOWES' REEF, to the northward of PORTO RICO, lat. 19° 17′, lon. 65° 50½′.

An American schooner, in 1817, struck on a rock to the northward of Porto Rico, in between 19° and 20° North. This was, probably, the same danger on which, some time after, the brig *Robert*, Captain Baxter, struck and remained several hours. The reef, which has been variously represented on the charts, was seen by Captain Clowes, in the ship *Caledonia*, on the 24th of April, 1825; and Captain Clowes assigns for its situation lat. 19° 17′, and lon. 65° 50½′. It is about a quarter of a mile in extent from East to West, with very little water on it. A quantity of sea-weed was seen at each end, which appeared to be drifting to the S.W. The ship was within a mile of the reef.

Whether these remarkable positions have any connexion with the great volcanic region shown to exist South of the Equator, something in the same direction, we require further facts to demonstrate. At present we can only point it out to the mariner as a very interesting field for observation.

DISCOLOURED WATER.

Captain Nockells, in the ship *Brightman*, of London, 5th of May, 1835, observing that the sea appeared of a dirty dark green, in lat. 41°, lon. 39° 19′, by chronometer, tried for soundings, but found no bottom at 240 fathoms.

Captain Nockells, in two previous voyages, found the water in the same place very much discoloured, which he supposed might originate from the melting of the ice in the northern latitudes. *This subject has been partially noticed in page* 484.

A remarkable change in the colour of the sea was observed by M. Dupetit Thouars, on board the French frigate *La Venus*, in lat. 21° 50′, lon. 19° 34′ W., in the same spot which Fraisier had already pointed out. The officers thought it was a bank, but no bottom was found with 550 fathoms.*

DEPTH OF THE ATLANTIC OCEAN, AND DEEP-SEA SOUNDINGS.

It was formerly considered that the lower bed of ocean-water was, from the pressure and weight of the incumbent masses, so dense as to be rather of the nature of solid matter than the natural fluid. However, a few facts will serve to dispel such a notion. The descent of the deep-sea lead is quite as rapid at a depth when the upper weight must be enormous, as at less distance from the surface, and no tendency to obstruct its downward passage can be observed at the greatest depth yet attained. Again, the whale fishers frequently find their prey to descend perpendicularly to such an enormous depth, that the idea of an impenetrable density, or even of any considerable increase of it, cannot be for a moment entertained.

It has been reserved for recent times to give an approximate knowledge of the depth of the ocean, and even now, notwithstanding numerous experiments hereafter cited, the conclusions are rather of a negative than a positive character, from the fact of several difficulties interposing as to the conclusion of the bottom having been attained, or the exact depth when so reached. That this depth is very great, exceeding the height of the mountains above its surface, may at least be assumed, but a more exact knowledge must be left for future experiment and discussion; there are doubtless many labourers in the field, and more intimate acquaintance with this interesting subject may be expected.

Among the earliest experiments, perhaps the first, of these deep-sea soundings is that recorded by Captain Edward Sabine, who, on November 13th, 1822, when about midway the Caymans and Cape Antonio, in the Caribbean Sea, sunk a cylinder and obtained the

* Voyage de la Venus, vol. iii. p. 446.

temperature at a depth exceeding 1,000 fathoms. This was followed by Captain Wauchope, in H.M.S. *Eurydice*, who gained water from a depth of about 1,300 fathoms. After that, Captain (since Admiral Sir Francis) Beaufort attained a depth nearly the same in the Strait of Gibraltar. As will be mentioned presently, there is some doubt as to whether the length of the sounding-line shows the exact depth attained. Although the results can scarcely be said to affect navigation, still, in a work like the present, so interesting a feature of its subject cannot be overlooked. We shall give here the details of some of those great experiments. The first was made by Captain Barnett, of H.M.S. *Thunder*, and is related in the *Nautical Magazine* for 1849.

On July 10th, 1848, lat. 25° 55′ N., lon. 66° 0′ W., between St. Thomas and Bermuda:—No current, sounded with 250 lb. of pig ballast; the line broke at about 3,250 fathoms; run out in 1^h 11′ 34″.

On August 3rd, 1848, lat. 41° 19′, lon. 44° 16′ W., between the Western Islands and Newfoundland Bank, same weight as before, current N.W. by W., 2 knots an hour. The whole line, 3,700 fathoms, run out in 1^h 15′ 27″, and held the boat with the reel for nearly half an hour against the current, when the line broke about 300 fathoms *below* the surface.

On the same day tried a line of iron wire, varying in size from Nos. 1 to 5, 4,000 fathoms in length, wound on a small reel, the smallest part first, with a weight attached of 61 lb., but a hand lead would have been better. It broke at 2,000 fathoms, which run out in 20′ 53″. This experiment was suggested by Lieutenant Mooney. The temperature of the surface water was 70°, air 75°, at 100 fathoms 59°, at 285 fathoms 50°, and at 600 fathoms 46°.

But the greatest length of line sent down hitherto is that effected by Lieutenant *J. C. Walsh*, in the U.S. schooner *Taney*, on November 15th, 1849, with the account of which we have been favoured, and is as follows:—

"Though we did so much less in *deep soundings* in the Atlantic than expected, owing to the rough weather, bad state of the vessel, and loss of so much wire in the first experiment, nevertheless the proving the ocean to have a depth of more than 5,700 fathoms (34,200 feet, or more than 6 statute miles), as was satisfactorily done in this first trial, is alone of much interest and importance. This vast depth, greater than the elevation of any mountain above the surface, and the greatest depth of the ocean ever yet measured, was reached without finding bottom, in lat. 31° 59′ N., lon. 58° 43′ W., on November 15th, 1849. The wire broke at this length, 5,700 fathoms, at the reel, and this large portion of our supply was thus so early lost. It preserved the exact plumb line throughout the sounding; there was a steady, uniform increase of weight and tension; no check whatever any instant of its descent; which prove that it could not have touched bottom before the break. It had been very carefully measured and marked, so that the *ocean here is deeper than* 5,700 *fathoms* can be relied upon as accurate. This great sounding is within 32 miles of the assigned position of the rocks called the False Bermudas, for which we were then in search, which fact alone should go far to disprove them. We had three choice chronometers, two of which performed with rare excellence throughout the cruise; and being a beautiful clear day, a number of sets of observations were taken in the morning, noon, and afternoon, so that the position was determined with the nicest accuracy.

"It proved the finest possible day for this work—the sea so smooth, and hardly a breath of wind. Though we found by trial in the morning a slight surface drift, setting to W.S.W., there was no change of position during the sounding, as proved by the observations—the great weight and extent of the wire, penetrating to such profound depths, seemed to serve as an anchor to keep the little schooner steady.

"In all our subsequent work under this head I found the heave of the sea, however slight, was the great difficulty—the lifting of the stern in the pitching motion causing such an immense increase of strain upon the wire, breaking it upon almost every occasion, on reaching about 2,000 fathoms. It is only under the most favourable circumstances, when the sea is very unusually smooth, that this mode of measuring its vast central depths can succeed." *

Whether the result of this important experiment is to be depended on as absolutely

* *Washington Herald*, November 8, 1850.

accurate, or that hidden causes may tend to impeach its correctness, will be alluded to presently. At all events it throws a great light as to the physical constitution of the bed of the ocean.

The Hydrographic Bureau of the United States, following up the investigations thus commenced, instructed Captain Platt, in the U. S. sloop of war *Albany*, to continue these experiments; and accordingly, between December, 1850, and April, 1851, besides numerous trials in the Atlantic, she carried a line of soundings across the Gulf of Mexico.

These soundings in the Atlantic have a negative result, but are very useful in assisting to determine the rate at which the weight descends, as it is this rate which, perhaps, is the only means of testing accurately the value of the experiment. We have given below a tabular statement of these soundings.

Date.	Lat. N.	Lon. W.	Fathoms.	Drift.	Perpendicular.	Rate per minute	
				fath.	fath.	fath.	
1850, Dec. 6	38 38	66 31	1,625a			60·2	no bottom
9	33 34	61 38	1,950b	800		30·9	ditto
11	30 5	58 52	1,000			90·9	ditto
11	29 58	58 48	1,500			53·5	ditto
12			600			85·7	ditto
12			550			110	ditto
12			1,000c			45·4	ditto
12			300			120	ditto
16	21 34	63 24	1,600w		1,600	57·1	ditto
29	17 54	67 28	1,200w	440	1,113	70·6	bottom reached
1851, Jan. 4	18 20	69 49	370w		370	74	ditto
5	17 16	71 26	1,275w	440	1,203	67	ditto
13	19 12	76 5	1,200w		1,200	[illegible]	line parted
16	22 29	84 35	420		420	84	bottom reached
16	22 32	84 32	720		720	90	ditto
28	24 5	82 5	470w		470	78·3	ditto
29	24 37	79 48	500w		500	76·9	ditto
Feb. 6	19 57	72 11	640		640	73·1	ditto
18	15 40	77 7	1,300w	220	1,280	76·4	bottom reached (good sounding)
19	11 7	79 13	600w	50	598	85·7	ditto
28	17 54	80 25	895w	100	885	74·5	ditto
28	16 6	80 34	680w		680	87·7	ditto
Mar. 3	19 20	81 50	660			110	line parted
3	19 20	81 50	585			117	ditto
3	19 20	81 50	377			107·7	ditto
4	21 25	84 45	990		990	67·1	bottom reached
5	25 5	86 22	445		445	96·7	ditto
15	19 12	92 56	170		170	—	ditto
16	19 30	94 30	530		530	73·1	ditto (good)
16	19 37	94 49	967		967	84	ditto (ditto)
April 3	25 56	95 51	490w		490	80·5	ditto
4	26 58	92 58	725w		[illegible]	65·9	ditto
5	26 36	88 56	982w	[illegible]	962	71·1	ditto
6	26 43	85 27	810w	160	795	82·6	ditto
7	25 23	85 19	700w	[illegible]	693	84·3	ditto
8	24 39	85 12	916w		916	83·2	ditto
10	23 47	83 32	600w	90	593	80	ditto

a. A 32-pound shot used. b. A bar of lead, weighing 14 lb., used.
c. Twelve pounds of iron bars used. w. Line waxed.

To these we will add the trials of Captain S. Barron, of the ship *John Adams*, also of the U. S. navy:—"On May 2nd, 1851, we had, for the first time, a fair chance at a deep-sea sounding, the results of which were in every respect satisfactory. In lat.

33° 55′ N., lon. 52° 34′ W., temperature, air 64°, water 65°, we got a fair up and down sound of 2,600 fathoms, 2,700 fathoms out; time of running out, 1h 23′ 10″, *and bottom without doubt.* It was very nearly a calm; and after hauling in about 100 fathoms of line, it 'grew up and down;' the line did not part till we had reeled 400 fathoms, losing 2,300 fathoms of line. While the shot remained on the bottom, I could draw it along with my naked hand; but so soon as it lifted, I could not move it with a glove on, the weight was so great and the pain to my hand so severe. One of our quartermasters, as strong a man as we have aboard, could not raise the shot *an inch* at 2,000 fathoms' depth.

"On April 28th, in lat. 34° 35′ N., lon. 67° 41′ W., we brought the ship to, and ran out 3,000 fathoms of line in one hour, the line parting without getting bottom. *May 4th.*—Sounded to-day in a calm; line got foul of the rudder when 2,000 fathoms were out, and parted; put two shots on to the remaining 3,000 fathoms, which run out rapidly; no bottom. 5,000 fathoms of line lost to-day.

"*May 7th.*—Weather too rough for sounding till to-day. To-day we sounded, and got bottom with 5,500 fathoms of line. Time of running out, 2h 44′ 28″. Lat. obs., 32° 6′ N., lon. 44° 47′ W; drift, 3 miles; temp., air 66°, water 68°; used two 32-pound shot; lost 5,500 fathoms of line. It is difficult for us to say what our up and down sound was. The other sound that I have given you was almost in a calm, and the sound was 'up and down,' and no mistake. After the shot took the bottom to-day, the quartermaster held the line in his hand *three minutes* without any difficulty. We all had a feel of it, and it was determined that no line would run off the reel but that taken off by the ship's drift, and that she would take off by her drift the line as long as it would run; but, of course, *much slower when on the bottom;* this might not be the case, particularly when *checked for three minutes*, with the weight of two 32-pound shot attached, and 5,000 fathoms of line out, if it was not at the bottom.

"Cast at 9h 22′ 32″:—2,000 fathoms, 10h 2′ 20″; 3,000 fathoms, 10h 30′ 18″; 4,000 fathoms, 10h 59′ 30″; 5,000 fathoms, 11h 44′ 30″; 5,500 fathoms, 12h 7′ 0″.

"This sounding carries internal evidence of its correctness; corrected for drift it gives 28,950 feet as the greatest depth at which the bottom has ever yet been reached. The rate of descent given for the depths of 2,000, 3,000, 4,000, and 5,000 fathoms, is a decreasing rate, and it conforms with the rate of the other soundings generally. The average rate for the first 2,000 fathoms was 50·4 fathoms in a minute, whereas the rate of descent for a sounding of 2,300 fathoms, on May 10th, lat. 31° 1′ N., lon. 44° 31′ W., was only 32 fathoms per minute. Hence I infer that the shot on May 10th had reached the bottom sooner than was expected, for this cast was only 67 miles from that of the 5,500 fathoms the day before, and the officers, doubtless, did not expect the shot to reach the bottom so soon. The drift of the ship probably continued to take the line out after the shot had reached the bottom, for that it was on the bottom, the great strain felt upon the line leaves no doubt. My inference is, therefore, that the sea here is *not* 2,300 fathoms deep, while it is more than twice that depth 60 miles farther to the North.

"*May 17th.*—Peak of Pico, N. 18° E., distant 24 miles. Sounded in 670 fathoms water; lost the whole quantity of line out. *May 21st.*—Lat. 35° 7′ N., lon. 25° 43′ W.; temperature, air 65°, water 64°. Found bottom with 1,040 fathoms of line. Time of running out, 19′ 58″."

Observations.—There are several difficulties in the way of forming any just conclusions from the experiments here described; but as they are the first of an important class, we have given them nearly in detail; but at present it would seem difficult to elicit any definite law as to the rate of descent of the sounding weight, or of the depth thereby ascertained. In looking at the time occupied in the experiments made in the *Albany*, there are such great discrepancies, and also in all the other results as to the rate of descent, that it is manifest that we have not yet arrived at the conclusion as to what the proper distance per minute is due to a weight passing through strata of water at differing depths.

It was supposed that the line being of one size and the weight a 32-pound shot of the same form, that these soundings and observations would soon afford the means of determining, with some degree of approximation at least, the law of descent which would govern a 32-pound shot sinking in sea-water, and drawing after it this particular line. This, however, cannot be said to have been satisfactorily done.

Another very important consideration is—what effect would under currents have on the line in passing through it? From the remarkable trial made by Lieutenant Walsh, cited

on p. 260, 261, when in several instances unsuspected and deep-seated currents were found, and in one instance at a velocity of 1¾ knots, and in others of 1½, 1¼, and 1 knot, and these, too, moving in quite contrary directions to that otherwise ascertained, it must be considerable. It is possible, nay probable, also, that in the vast depths penetrated in these soundings, more than one such submarine and opposing current would have to be crossed.

Now it is certain that a current must act upon the *bight* of the sounding line after the weight has passed through it, and it may even operate in swerving the weight itself from its perpendicular descent at great depths. Therefore it would be difficult to state what the exact depth was that the sounding weight would reach, and it is familiar to all, that a very great strain is required to get a towing line straight again if the bight of the line gets into the water. Therefore it would seem that such submarine currents have the effect in causing the irregularities in the times required to sink a certain quantity of line.

Again, the force exerted by a current against the *bight* of the sounding line will have the effect of taking the twine off the reel at nearly *double* its own velocity. So that supposing the ship stationary at the surface, and the shot at the bottom, such submarine streams as those recorded by Lieutenant Walsh would take off the line nearly as fast as the shot would sink it, and it would be nearly as difficult to haul it in as it would be to raise the shot itself from a great depth, with all the friction caused by the length of the twine.

From these considerations it must be supposed that the depths stated, even when it is certain that the bottom has been reached, are in excess, and this, too, in an uncertain degree, unless any judgment can be formed from the irregularity of its descent.

To obviate these sources of error or doubt, a line of fine sewing silk has been proposed, but we have not heard of any trial with this. It is most probable that wire would give the most correct result, both from its offering less surface to be acted on, and from its gravity preventing the sounding weight from being buoyed up, as must be the case with any line specifically lighter than sea-water.*

We would here give the directions for deep-sea soundings, as issued by the American hydrographers, but as they do not differ from those previously recommended, or what would suggest themselves to the ingenious seaman, we have omitted them: the chief features being that the line should be of smooth wrapping twine, the length to be marked by silk threads tied tightly around at every 100 fathoms, and each 1,000 fathoms by a silk thread of different colour, and the separate hundred of the 1,000 having the thread drawn through the strands as many times as there are hundreds to be marked.

AN ACCOUNT OF THE FINE DUST WHICH OFTEN FALLS ON VESSELS IN THE ATLANTIC OCEAN.

By Charles Darwin, Esq., F.R.S., F.G.S.

Many scattered accounts have appeared concerning the dust which has fallen in considerable quantities on vessels on the African side of the Atlantic Ocean. It has appeared to me desirable to collect these accounts, more especially since Professor Ehrenberg's remarkable discovery that the dust consists, in considerable part, of Infusoria and Phytolitharia. I have found fifteen distinct statements of dust having fallen; and several of these refer to a period of more than one day, and some to a considerably longer time. Other less distinct accounts have also appeared. At the end of this paper I will give the particular cases, and will here only refer to the more striking ones and make a few general remarks.

The phenomenon has been most frequently observed in the neighbourhood of the Cape Verd Archipelago. The most southern point at which dust is recorded to have fallen is

* The twine furnished to the *Albany* for this service unfortunately proved too weak. It measured about 150 fathoms to the lb. weight, and was intended to be strong enough to bear a weight of 50 or 60 lb. When used for sounding, it was wound on a delicately constructed reel, which would turn with as little friction and to the least force possible. The usual sounding weight was a 32-pound shot. When the shot was cast overboard, it was allowed to take the line as fast as it would, as in heaving the log the ship is allowed to take the line.

noticed by Captain Hayward,* on whose vessel it fell whilst sailing from lat. 10° N. to 2° 56′ N.; the distance from the nearest of the Cape Verd Islands being between 450 and 850 miles. Respecting the northern limit, the water for a great distance on both sides of Cape Noon (in lat. 38° 45′) is discoloured, owing in part, according to Lieutenant Arlett,† to the quantities of falling dust. Hence the phenomenon has been observed over a space of at least 1,600 miles of latitude. This dust has several times fallen on vessels when between 300 and 600 miles from the coast of Africa: it fell, in May, 1840, on the Princess Louise‡ (in lat. 14° 21′ N., lon. 35° 24′ W.), when 1,030 miles from Cape Verd, the nearest point of the continent, and therefore halfway between Cayenne in South America and the dry country North of the Senegal in Africa.

On the 16th of January (1833) when the *Beagle* was 10 miles off the N.W. end of St. Jago, some very fine dust was found adhering to the under side of the horizontal wind-vane at the mast-head; it appeared to have been filtered by the gauze from the air, as the ship lay inclined to the wind. The wind had been for twenty-four hours previously E.N.E., and hence, from the position of the ship, the dust probably came from the coast of Africa. The atmosphere was so hazy, that the visible horizon was only 1 mile distant. During our stay of three weeks at St. Jago (to February 8th) the wind was N.E., as is always the case during this time of the year; the atmosphere was often hazy, and very fine dust was almost constantly falling, so that the astronomical instruments were roughened, and a little injured. The dust collected on the *Beagle* was excessively fine-grained, and of a reddish-brown colour; it does not effervesce with acids; it easily fuses under the blowpipe into a black or gray bead.

In 1838, from the 7th to the 10th of March, whilst Lieutenant James, in H.M.S. *Spey*, was sailing, at the distance of from 330 to 380 miles from the continent, between lat. 21° 10′ N., lon. 22° 14′ W., and lat. 17° 43′ N., lon. 25° 54′ W., considerable quantities of dust fell on his vessel, four packets of which, together with a written communication, I owe to the kindness of Mr. Lyell. The dust which fell on the first day (or the 7th) was preceded by a thick haze, and it is coarser than that which fell on the succeeding days: it contains numerous irregular, transparent, variously-coloured particles of stone about the $\frac{1}{1000}$th of an inch square, with some few a little larger, and much fine matter. The fact of particles of this size having been brought at least 330 miles from the land, is interesting, as bearing on the distribution of the sporules of cryptogamic plants and the ovules of Infusoria. The dust which fell on the three succeeding days resembles in appearance and in its action under the blowpipe, that collected by myself off St. Jago, and is so excessively fine, that Lieutenant James was obliged to collect it with a sponge moistened with fresh water. As the wind continued nearly in the same direction during the four above-mentioned days, and the distance from the land was only a little increased after the first day, it would appear probable that the coarser dust was raised by a squall with which the breezes on this coast so often begin blowing.

With respect to the direction of the wind during the falls of dust, in every instance where recorded, it has been between N.E. and S.E.; generally between N.E. and E. In the case, however, given by the Rev. W. Clarke,§ a hazy wind which had blown for some time from E. and S.E. first fell calm, and was succeeded for a few hours by a S.W. wind, and then returned strongly to the East; during this whole time dust fell. With respect to the time of year, the falls have always occurred in the months of January, February, March, and April; but in the case of the Princess Louise in 1840, as late as on the 9th of May. In the one year of 1839, it has chanced that dust has been recorded as having fallen in the Atlantic (as may be seen in the references) on the 14th and 15th of January, and on the 2nd, 4th, 9th, 10th, 11th, 12th, and 13th of February. I may add, that Baron Roussin,‖ during his survey of the north-western African coast, found, that whilst the wind keeps parallel to the shore, the haze and dust extend seaward only a short distance; but when, during the above four specified months, the harmattan blows from the N.E. and E.N.E., accompanied by tornadoes, the dust is blown far out, and is raised on high, so that stars and all other objects within 30° of the horizon are hidden.

From the several recorded accounts,¶ it appears that the quantity of dust which falls on vessels in the open Atlantic is considerable, and that the atmosphere is often rendered

* Naut. Mag., 1839, p. 364. † Geographical Journal, vol. vi. p. 296.
‡ Edinburgh New Philosophical Journal, vol. xxxii. p. 134.
§ Proceedings of the Geol. Soc., vol. iv. p. 145. ‖ Naut. Mag., 1838, p. 824.
¶ Nautical Magazine, 1837, p. 291. Another account is given by *Mr. George Peacock*, as

quite hazy; but nearer to the African coast the quantity is still more considerable. Vessels have several times run on shore owing to the haziness of the air; and Horsburgh,* recommends all vessels, for this reason, to avoid the passage between the Cape Verd Archipelago and the main land. Roussin, also, during his survey, was thus much impeded. Lieutenant Arlett found the water so discoloured,† that the track left by his ship was visible for a long time; and he attributes this, in part, to the fine sand blown from the deserts, "with which everything on board soon becomes perfectly caked."

Professor Ehrenberg ‡ has examined the dust collected by Lieutenant James and myself; and he finds that it is in considerable part composed of Infusoria, including no less than sixty-seven different forms. These consist of thirty-two species of silicious-shielded *Polygastrica;* of thirty-four forms of *Phytolitharia*, or the silicious tissues of plants; and of one *Polythalamia.* The little packet of dust collected by myself would not have filled a quarter of a teaspoon, yet it contains seventeen forms. Professor Ehrenberg remarks, that as thirty-seven species are common to several of the packets, the dust collected by myself, and on four successive days by Lieutenant James, must certainly have come from the same quarter; yet mine was brought by an E.N.E. wind, and Lieutenant James's by a S.E. and E.S.E. wind. The Infusoria are all old known species, excepting one allied to a Hungarian fossil; and they are of fresh water origin, with the exception of two (*Grammatophora oceanica* and *Textilaria globulosa*), which are certainly marine. Professor Ehrenberg could not detect any of the soft parts of the Infusoria, as if they had been quickly dried up, and hence it would appear that they must have been caught up by the wind some time after having been dead. The greater number of the species are of wide or mundane distribution; four species are common to Senegambia and South America, and two are peculiar to the latter country: moreover, it is a very singular fact, that out of the many forms known to Professor Ehrenberg as characteristic of Africa, and more especially of the Sahara and Senegambian regions, none were found in the dust. From these facts one might at first doubt whether the dust came from Africa; but, considering that it has invariably fallen with the wind between N.E. and S.E., that is, directly from the coast of Africa; that the first commencement of the haze has been seen to come on with these winds; that coarser particles have first fallen; that the dust and hazy atmosphere are more common near the African coast than further in the Atlantic; and lastly, that the months during which it falls coincide with those when the harmattan blows from the continent, and when it is known that clouds of dust and sand are raised by it, I think there can be no doubt that the dust which falls in the Atlantic does come from Africa. How to explain the enigma of the absence of characteristic African forms and of the presence of two species from South America, I will not pretend to conjecture. Finally, I may remark, that the circumstance of such quantities of dust being periodically blown, year after year, over so immense an area in the Atlantic Ocean, is interesting, as showing by how apparently inefficient a cause a widely-extended deposit may be in process of formation; and this deposit, it appears from the researches of Professor Ehrenberg, will in chief part consist of fresh water Polygastrica and Phytolitharia.

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having occurred on board H.M.S. *Winchester*, in February, 1829:—"Shortly after leaving Tenerife, when in about lat. 25° 30′ N., and some 250 miles from the coast of the Great Desert of Sahara, the weather became very hazy and sultry, and one morning, at daylight, the lays of the lower rigging were observed to be filled with fine, reddish-brown dust, and the decks, whilst being washed, were in as muddy a state as the pavement of a street after a shower. This hazy unpleasant weather continued all day, and quite obscured the horizon; rendering it difficult to observe even the crest of the waves beyond a few cables' length, and the sun appeared as viewed through the red shade-glass of a sextant. Towards evening it grew worse, the wind became light, and the haze was almost as dense as a London November fog, the air full of fine red dust, which made it difficult and unpleasant to breathe. So thick was it, that a young man having fallen overboard, the boats which were lowered in search of him could neither find him nor scarcely find the ship for some time afterwards, and this though guns were fired."—(*Nautical Magazine*, 1847, p. 354.)—Edinburgh Philosophical Journal, vol. vii. p. 402; Howard Malcolm's Travels, vol. ii. p. 200.

* Horsburgh's East Indian Directory, p. 11.

† In Tuckey's Narrative of the Congo Expedition, p. 10.

‡ These microscopic organized bodies have been described in the "Monatsberichten der Berlin Akad. der Wissens, Mai 1844; u. 27 Februar 1845." In the latter paper a full list of the names is given; the column marked St. Jago includes those selected by myself.

APPENDIX;

CONTAINING

HINTS AND REMARKS ON GENERAL NAUTICAL PRACTICE; WITH OTHER SUPPLEMENTARY PAPERS, TABLES, ETC.

I.—MODE OF ASCERTAINING CURRENTS; LOG-LINE, LOG-GLASS, &c.; STEERAGE; SPANISH PILOTS; DEAD-RECKONING IN SHOAL WATER. COMMUNICATED BY CAPTAIN LIVINGSTON.

In allusion to some remarks made by an able writer, in a critique on the voyage of the Baron Alexander von Humboldt, Captain Livingston says:—"The reviewer censures M. de Humboldt for stating that, by comparing the place of the ship, as deduced from his chronometer, and comparing that with the pilot's reckoning, he was able to discover the smallest variation in the direction and velocity of the currents. The reviewer also says that the chronometer had not been rated; but on what authority he states this, I am at a loss to conjecture; as a man of Humboldt's acquirements and abilities could not, for a moment, think of ascertaining the longitude by means of a timekeeper, of which he knew nothing of the rate; and, indeed, it appears, in the same paragraph, that Humboldt predicted the exact time at which the land would be seen, and which, we presume, must be from the use of this very chronometer; of which he consequently must have known the rate.

"There can be no doubt that the LOG-LINE, GLASS, &c., are liable to be erroneous; but if the master, or whoever acts as pilot of a vessel, be attentive to his duty, any error in these will soon be discovered. For my own part, I can say, that rarely three days pass, when I am at sea, without examining the glass by the seconds hand of my watch, and causing the log-line to be measured by marks which I have always measured off on the deck; and the length I have found, by experience, to answer best, is 45 feet to the knot for a 28-seconds glass, and 48[2] nearly for a 30-seconds. In a vessel, however, the side of which was high out of the water, I have allowed something for the height of the side, which causes the line to make a different angle from what it does in a low one, and, of course, requires a little more length of line, proportioned to the vessel's height out of the water: but, what has been so often stated by seamen, 'that a fast-sailing vessel requires a shorter line than a dull one,' I have found, from experience, to be inaccurate; as I have been in both remarkably fast, and remarkably slow, vessels; and a careful attention to the log has convinced me of the equality of the length of line necessary for both.

"What has been said relative to steerage is strictly true, that 'a vessel's head vibrates according to the skill, or want of it, in a helmsman;' but it is really surprising how nearly, in general, the errors on the one side compensate those on the other; inasmuch, at least, as regards most vessels: a cutter, however, when running with the wind on the quarter, will always gripe to *windward*, in spite of the best helmsman.

"A sneer at the unskilfulness of SPANISH PILOTS is unwarranted. Probably no country in the world produces better navigators than the Spaniards; as, in every maritime town of note, they have a regular academy for pilots, supported at the public expense, in which even the practical part of seamanship is taught on large models of full-rigged ships, which turn upon a pivot, so as to perform every manœuvre; and reefing or setting sails, with the other operations to be performed aloft, is done by means of such ladders as are used by painters. No person can take charge of even a *merchant-vessel*, as second mate, until he has undergone a regular examination. If these regulations were adopted in Britain, it would be *well for our underwriters*, and save '*many fine ships and valuable lives.*'

"If CURRENTS are not to be ascertained by the difference between the ship's place by

account and by observation, how are they to be ascertained? It may be answered, by the plan proposed in all school-books, which is, by sinking a pitch-kettle, or other heavy article, to a great depth from a boat; this I have often tried, but the results never appeared to me satisfactory: besides, the log-line, vague as it may be, must in this way still be trusted to. Again, if a current can be ascertained in this way, it will be a surface-current only; and there may even be a counter-current beneath, which, from its action on the kettle, or heavy article, to which the boat rides, may make the surface-current appear to set more strongly than it really does.

"I do not pretend to say that the mode of finding the set and velocity of currents, by comparing the ship's true place, as found by observations for latitude, or by lunar or chronometric observations for longitude, with that assigned to her by mere calculations of the courses and distances steered, is a certain one; on the contrary, I am conscious it is far from being so: but yet it seems to be the mode of practice by which the nearest approximation to the truth is obtained.

"If, on heaving the log, proper attention be paid to the mode of the person who heaves it, much inaccuracy will be obviated, and a person who has practice will come wonderfully near the truth. My own mode is, to take the average of the distance shown by the log at the beginning and end of the hour, as the distance run during it, except when any sudden increase or decrease of the ship's rate takes place, near the beginning or end of the hour, in which case I proportion it according to the best of my judgment, and often, under particular circumstances, I have caused the log to be hove more than once between the regular intervals of an hour, to satisfy myself. The error in *turning* the glass will seldom make 1 foot of difference.

"LEEWAY and HEAVE of the sea must be taken into consideration. The former, in particular, is, at times, a puzzling subject, even to the most experienced, when a current prevails in any strong degree. Upon the whole, it must be allowed that those only who are well acquainted with, and practise, lunar and chronometric observations, can be sure of their situation at sea. No dead-reckoning, however carefully kept, can guarantee this."

DEAD-RECKONING in SHOAL WATER, as on the COAST of GUYANA, &c.—"As the greatest uncertainty in the situation of a vessel arises from the errors in the dead-reckoning, caused by currents, to diminish such errors, and render the computation more correct, it is advisable to take off the log-ship from the log-line, and to substitute a leaden weight, weighing four, six, or eight pounds, as may be judged necessary; this, taking the bottom (when the log is hove with it, in place of a log-ship), will not so easily follow the vessel, or be influenced by currents. By this mode it is clear the log will show the whole distance which the vessel runs, whether caused by winds or by currents. Then, having made fast the log-line, before you haul it in, mark the bearing of it, and the opposite point or direction will be the course which the vessel makes good. It is clear that, by this mode, the course and distance ought to be as exactly found as if no current existed. If you heave the log with a ship, in the usual manner, as well as a log with a lead attached to it, and compare the distance by it, and the course which the vessel appears to make by compass, with the distance and course found by the proposed method, you will be able to ascertain the direction and velocity of the current."—*Derrotero de las Antillas.*

NOTE, BY THE TRANSLATOR.—In using the log-line with a leaden weight, as recommended above, I am of opinion that a few fathoms of extra stray-line should be used; and, if great accuracy be required, as in making the comparison between it and the common log, &c., to ascertain the strength of the current, an allowance should be made for the angle the line makes with the surface of the water, in order to equalize it with the log-line, as usually hove.—*Andr. Livingston.*

II.—ON THE ARTIFICIAL HORIZON.

It is of the utmost importance to the sailor that he should at all times be enabled, by astronomical observations, to verify his position, and avoid all uncertainty as to his locality or course, which he must inevitably labour under if he has to depend, for any lengthened period, entirely on his dead-reckoning. Now it must have occurred to the experience of every one, that such observations may have been had, perhaps at very critical times, but

but for one impediment,—that of the *horizon* being obscured by fog or haze. It is true, that the common reflecting horizon of mercury, or other substitute, will obviate this on *shore;* but even this frequently fails in low latitudes, from the fact of the great angle, formed by the height of the sun, being beyond the limits of the instrument. A substitute for the natural horizon is proposed in an instrument, that can be attached to the sextant, the invention of Commander A. B. Beecher, R.N., which may be used at *all* times, on shore, or at sea, provided the motion be not too violent, and the observer have sufficient experience in its use.

In the construction of this appendage to the sextant,* it was assumed that the line of the sea horizon forms a horizontal diameter to the field of the telescope, at right angles to the plane of the instrument. Accordingly, a place was assumed for this line, so as to appear, when seen through the telescope, to be in the middle of the field of view, beyond the horizon glass. A point was next assumed beyond it, from which a pendulum was suspended, carrying an arm, at the extremity of which is a small slip of metal, which we will call the horizon vane. The upper edge of this vane, when made to coincide with the horizon line on the glass, and seen to do so through the telescope, completes the horizon for observation. In the middle of the upper edge of this horizon vane a small aperture is made, as, when the axis of the telescope is directed below the horizon, the vane would, but for this, entirely conceal the horizon line, by rising above it. These parts are arranged in a tube to be affixed, when required, to the sextant, the axis of the tube of the horizon corresponding exactly with that of the telescope of the sextant.

Another condition necessary for taking an observation is, that the plane of the sextant should be vertical; this is shown also by the horizon vane. For, should the instrument not be in this position, the pendulum being free to move in all directions, the upper edge of the horizon vane will not be parallel to the horizon line, but will form an angle with it. The observer then has to make the edge of the horizon vane and the horizon line coincide exactly with each other.

It will be evident, from the foregoing description of the instrument, that the observer, having to form his own horizon at the instant of observation on board ship, should place himself where there is the least motion, and especially to be screened from the wind. The exceeding delicacy of the suspension of the pendulum renders it also necessary that some means should be applied to overcome the tremulous motion occasioned by holding it in the hand, besides that of the motion of the ship; this is at once overcome by immersing the pendulum in a vessel of oil, which gives the observer a complete command over his instrument.

The tube thus fitted with the horizon, when this is required for use, is attached to the frame of the sextant, outside the horizon glass (two feet in the plate of the tube sliding into holes in the frame), and is held firmly to it by means of a screw (*S*), which always remains in the frame of the sextant, or of the horizon, for that purpose; and neither the horizon, nor anything belonging to it, interferes in any way with the sextant for its ordinary use.

The instrument is rendered available for night observation by a lamp, which, being fixed at the outer end of the tube, renders the whole of the arrangements visible. Thus the horizon is rendered as distinctly visible by night as by day, and equally available for observing altitudes of the planets by night, as for observing the altitude of the sun or moon by day. But the observer should not *attempt* to use the instrument afloat before he is proficient in its use on shore; and it perhaps is necessary to remark that, during very rough weather, it will not be possible to use so sensitive an instrument.

We have been thus particular in describing what must be of infinite service to the mariner. On the Banks of Newfoundland, in the Channel, on the coast of Africa, where haze is almost perpetual, it cannot fail of proving most beneficial to every commander, and we therefore recommend it to general attention.

In fact, we would caution the commanders of our ships not to turn aside from this valuable instrument, because it may not be available in *all* weathers. At a subsequent time, in moderate weather during a fog, they will regret it.

* Manufactured by R. B. Bate, 21, Poultry; and by C. Dennis, 118, Bishopsgate-street.

III.—REMARKS ON ASCERTAINING LONGITUDE, AND THE USE OF CHRONOMETERS, ETC.

1.—From the Directory of the late Captain Horsburgh, F.R.S., &c.

"Chronometers would be highly useful for the improvement of marine geography, were navigators to adopt a *uniform method*, in marking in their journals the longitude obtained by these excellent machines. In taking a departure for chronometers, at sailing from any port or head-land, the longitude *allowed* to that place should be marked distinctly in every ship's journal; and the longitude measured from it by chronometers (whether East or West) to every head-land, island, or danger, during the passage, ought to be carefully stated; by which means the *relative* meridians of those places will appear to view, and be ready to compare with the admeasurement of the same by other chronometers. But, unfortunately, the generality of navigators seldom mention in their journals the longitude allowed to the place of departure; and, instead of carrying on the longitude *made* daily from that meridian, by chronometers, they mark longitude *in* by chronometers. The journals, therefore, are of little or no use for any future purpose, on account of the *indefinite* manner in which the longitude is marked by chronometers. When the longitude, obtained by lunar observations, is carried on daily by chronometers, or up to any head-land, it ought also to be marked distinctly, in order to prevent any mistake.

"When lunar observations are taken, the objects on both sides of the moon ought always to be observed, if possible, and the mean taken; which will contribute to correct or modify the errors of the instrument, particularly when the distances are *nearly equal*, and fall on the *same part* of the arch of the sextant: and the difference of longitude *run by log*, between day and night observations, ought never to be applied in carrying on the one to the other, if there is a chronometer on board. If, for instance, some observations of the sun and moon are taken in the afternoon for longitude, altitudes of the sun should be taken nearly at the same time, to obtain the error of the chronometer, or what it is fast, or slow, for the apparent time at ship; having also marked down the time, by chronometer, when the distances of the sun and moon are observed, the error of chronometer must be applied to it, to reduce it to the apparent time of observation. When the observations are taken afterward by the moon and stars in the night, the time, by chronometer, ought likewise to be marked down: to which apply its error, and the quantity of loss or gain of the chronometer (proportionate to its daily rate), for the interlapsed time between these observations and those taken in the afternoon, by sun and moon. The apparent time at ship, when the observations of the moon and stars were taken, will then be measured by chronometer to the meridian of the place where the observations of sun and moon were taken in the afternoon, and the mean of both should be taken for the longitude of that place, after comparing the apparent time of observations with the Greenwich apparent time. By using the chronometer in this manner, the errors liable to arise from currents, and from the advancement of ships' run by log, *between* day and night observations, will be avoided."

2. General and Important Rules given by Captain Rich. Owen, R.N.

1. The time for receiving chronometers on board, previous to sailing, will differ a little according to circumstances; but it is strongly recommended that they should be received on board at least a week previous to sailing, in order that a rate may be obtained for them, in the position and place they are constantly to remain, as it may be taken for an absolute maxim in general practice, that *the rate of a chronometer obtained on shore will not be the same when removed to the vessel*. There may be a few exceptions to this general rule, but it must still hold good as a practical maxim.

2. The first thing to be attended to, after the timekeepers are on board, and in their proper place, is to be regular in the time, and careful in the manner, of winding them up. Our practice on board the *Leven* was to wind up at noon, and never *pipe to dinner* until they were reported to be wound up and compared. Some method of this kind may always be adopted in men-of-war, and it would be advisable in merchant vessels to devise some plan by which the winding up of the chronometers should not depend upon the memory of any single person, the want of which must, in many instances, have caused the watch to run down; which will, at all times, alter its rate, and, not unfrequently, injure the chronometer. Our eight-day watches we wound up on Sunday, which will always be better remembered than any other day in the week. In winding up the small chronometers in watch cases, the left hand should rest against the body of the person winding

it up, to prevent his giving it a rotary motion by turning the watch *on* the key, instead of the key *in* the watch. This practice is very common, and very bad. In winding up chronometers, the turns of the key should always be counted, and the last turns made gently and carefully, until it is felt to butt. It has sometimes happened to persons over careful, that they have let their chronometers run down, by having calculated the number of turns, and never winding close up, from fear of injury to the chain or works, by which they have always lost a little of the chain each day, and, after two or three months, the chronometer is found to stop just at the time it should be wound up.

3. Of all the methods used by seafaring men to ascertain the rates and errors of their chronometers, that by equal altitudes of the sun in an artificial horizon is much to be preferred, both on account of its simplicity and the very great degree of correctness attainable by it, and being likewise free from the effects of instrumental error, or wrong latitude. The observations may be made at any time, with a sextant, when the sun's altitude falls between 20° and 60°, provided it be not too near noon, as under two hours, or at least one hour and a half, the sun's motion, in high latitudes, being then very slow.

4. The method of rating chronometers by *lunar observations* obtained at sea has been by some much insisted on, but we are fully satisfied that they can never be made use of, for that purpose, in general practice. Lunar observations are of great use for detecting a *gross error* in the longitude by chronometer, from any sudden change of rate or defect in the watch, &c.; but it must be evident that, where this is discovered, it would be unsafe to trust to such a chronometer for the remainder of the voyage. We would not be understood to discourage or depreciate the lunar method of obtaining the longitude, as we are fully aware of its great utility, particularly in long voyages: but we would strongly dissuade persons from using such means for *rating* their chronometers."*

3.—Remarks extracted from those of Captain FitzRoy, R.N.

"Frequently employing chronometers in boats and very small vessels has strengthened my conviction, that *temperature* is the chief, if not the only, cause, generally speaking, of marked changes of rate: and the balances of few watches are so well compensated as to be proof against a *long* continuance of higher or lower temperature.

"It often happens that the air in port, or near the land, is at a temperature very different from that over the open sea in the vicinity. Hence the difference sometimes found between harbour and sea rates.

"The changes so frequently noticed to take place in rates of chronometers moved from the shore to the ship, and the reverse, are well known to be caused partly by change of temperature, and partly by change of situation.

"I have never found chronometers go better than when the boxes were bedded in sawdust, and the watches moving freely in well-oiled gimbals. Suspending them in cots not only alters their rate, but makes them go less regularly.

"When fixed to a solid substance, they feel the vibrations caused, by people running on the decks, by shocks, and by chain cables running out. A cushion, wool, hair, or any such substance, is preferable to a solid bed; but I can think of nothing better than plain dry sawdust.

"The *Beagle's* chronometers were suspended in gimbals, as usual, within a wooden box; each was placed in sawdust, divided and retained by partitions, upon one of two wide shelves. The sawdust was about 3 inches thick below, as well as at the sides of each box, and formed a bed for it which rose rather above the centre of gravity of the box and watch; so that they could not be displaced unless the ship were upset. The shelves, on which the sawdust and boxes were thus secured, were between decks, low down, and as near the vessel's centre of motion as could be contrived. Placed in this manner, neither the running of men upon deck, nor firing guns (forward), nor the running out of chain cables, caused the slightest vibration in the chronometers, as was often proved by scattering powder upon their glasses, and watching it with a magnifying glass, while the vessel herself was vibrating to some jar or shock.

* *Essay on the Management and Use of Chronometers, by Richard Owen, Comm. R.N.* Prefixed to the volume of Latitudes and Longitudes of the Points of Africa, &c., by Captain W. F. Owen, 4to. 1827.

"All the watches were in one small cabin, into which no person entered, except to compare or wind them, and in which nothing else was kept. The greater number were never moved from their first places, after being secured there in 1831, until finally landed at Greenwich in 1836."—*Captain FitzRoy's Appendix*, pp. 325, 326.

5.—THE FOLLOWING EASY METHOD *of comparing the* TIME *indicated by any number of chronometers, with the* GIVEN *time at a certain station, was published by the* Rev. F. Fallows, astronomer at the Cape of Good Hope, in 1824:—

"Let a transit instrument, or even a sextant with an artificial horizon, be established in a *conspicuous* situation on shore, where a clock can always be regulated to true time: then provide a powerful Argand's lamp with a shutter, so as to be able to darken the lamp instantaneously: a few minutes before a certain hour in the evening, notice being previously given to the ships, let the lamp be lighted, and at the proper instant of time let it be darkened: this may be repeated several times at short known intervals. Then the errors of every chronometer on board of all the ships, from which the lamp can be seen, are immediately found. After a certain number of days, let the same be repeated, when the daily *ship rates* will be given, since they are only the differences of these errors divided by the number of days elapsed between the two sets of observations. It is evident that, for greater truth, these observations may be repeated at pleasure. No objection can be made from the chronometer's being generally below deck, as one person might have his eye upon it, and another immediately above him, on the upper deck, might give a stamp with his foot the instant the lamp is darkened." But the superior method is by the time-ball lately established in various places.

6.—Sir J. Herschel gives the following very simple and efficient means of ascertaining the rate of a chronometer or clock, a most important desideratum, where apparatus is wanting, and which is available at any time or place on shore:—"An observer need only station himself to the North of some well defined vertical object, as the angle of a building, and, placing his eye exactly at a certain fixed point (such as a small hole in a plate of metal, nailed to some immoveable support), notice the successive disappearances of any star behind the building by a watch. When he observes the sun, he must shade his eye with a dark coloured or smoked glass, and notice when its western and eastern edges successively come up to the wall, from which, by taking half the interval, he will ascertain (what he cannot directly *observe*) the moment of disappearance of its centre. This is an excellent practical method of ascertaining the rate of a clock or watch, being exceedingly accurate if a few precautions are attended to; the chief of which is, to take care, that that part of the edge, behind which the star (a bright one, *not a planet*) disappears, shall be quite smooth; as, otherwise, variable refraction may transfer the point of disappearance from a protuberance to a notch, and thus vary the moment of observation unduly; this is easily secured, by nailing up a smooth-edged board."—*Astronomy*, p. 74. It need scarcely be remarked, that the interval between the two appearances of a star is a sidereal day, or $23^h\ 56'\ 4{\cdot}09''$; with the equation, for solar time, every sailor is acquainted.

7.—A little instrument has been invented by Mr. E. J. Dent, which, from its portability, and simplicity, bids fair to become of considerable service in rating and detecting errors in chronometers. It is called the *Dipleidoscope*, or Double Reflecting Meridian and Altitude Instrument. By means of this, an observer may ascertain, within very narrow limits, the time of transit of any of the heavenly bodies, and that by three observations, which must, therefore, in a great measure, destroy the errors in each. It consists of three reflecting planes, so arranged, that the images are made to approach and cross each other, and thus afford ample time for observation, which, in the previously mentioned mode, may not be the case. It is very easily fixed in the meridian, and for any commander visiting a port offers an excellent transit instrument for rating his chronometer with.

IV.—ON THE PROPER METHOD OF LAYING DOWN A SHIP'S TRACK ON SEA-CHARTS; WITH SOME REMARKS ON THE IMPORTANCE OF TIMEKEEPERS IN NAVIGATION. BY CAPTAIN BASIL HALL, R.N., F.R.S., LONDON AND EDINBURGH.

There is no point in practical navigation of more importance than the allowance for the direction and velocity of currents; and, although the introduction of timekeepers and lunar observations has led to much more accurate methods of making this estimate, yet

there is unquestionably still much obscurity belonging to this branch of the subject: and although it is scarcely to be hoped, that we shall ever arrive at a correct knowledge of the laws which regulate the great streams of the ocean, we may certainly hope to approach much nearer, than we are at present, to the true state of the facts; and that we shall eventually be able, in the practice of navigation, to make much juster allowance than we now do for the influence of these powerful agents.

Probably much of the obscurity which belongs to this subject arises from the inaccurate way in which the tracks of ships, exposed to the influence of currents, have been laid down on our charts; for the method most in use has this essential defect, namely, that on inspecting the chart of a preceding navigator, it is rarely possible to discover where any current began, where it ceased to act, what was its direction, or what its velocity,—all essential points.

The mode proposed in this notice answers all these questions, and is quite as easy in practice as that in most general use. It is so obvious that I cannot help being sure that it must have occurred to many practical navigators; but as I have never met with it in any treatise on navigation, and have never seen a single chart in which the tracks were so laid down, I trust this notice will not be superfluous.

The common method is as follows:—The ship's place of each day, as estimated from the log-board, is noted on the chart; and also the place, as deduced from chronometers and lunar observations. The first is called the place by dead-reckoning, the other the true place. The line joining the true places at noon is called the true track; and that joining the others is called the track or course by dead reckoning. As it happens, invariably, that these two tracks separate very early in the voyage, and never afterward come together, unless by accident, it is obvious that, upon inspecting the chart, no information will be afforded as to the point where the current began, or where it ceased, or what was its set or its velocity; all that we see is two tracks wandering apart from one another, and it always requires some calculation and measurement to come to anything like an estimate of the true effect of the current.

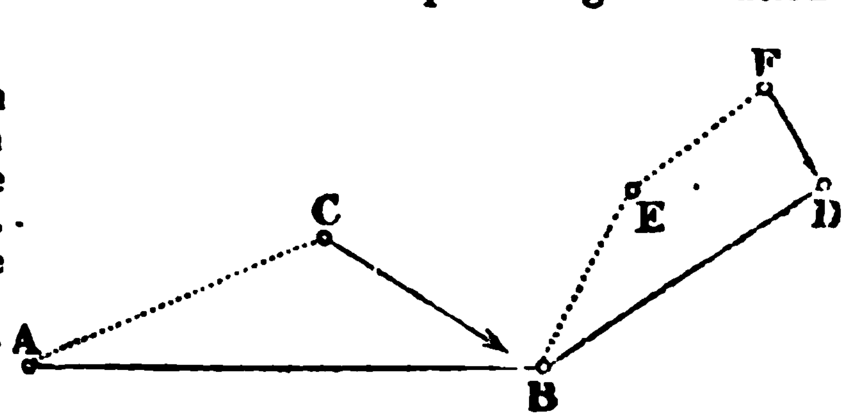
The tracks laid down on some of Mr. Arrowsmith's Maps of the Atlantic are, on this account, altogether useless, although inserted expressly to show the effect of the current. And I speak from experience when I say that a chart marked in this manner, whatever attention may have been paid to it by the navigator, tends only to confuse, and not to instruct.

The method which it is proposed to substitute is this:—Let the true place be laid down each day as before, either at noon, or, which is better, at the precise moments of observation for the longitude. *Let a fresh departure be taken from every such true place*, so noted in the chart; and whenever a true place is marked on the chart, let the place by dead reckoning at that moment, estimated by log-board from the last true place, be also noted down. From each true place let two lines be drawn, one to the next true place, and the other to the dead reckoning place at the same moment.

It will follow from this, that the true course of the ship will be one continued unbroken line, but the dead reckoning course will be a series of terminated lines running off from the successive true places. The advantages of this method are these: in the first place, it will be evident that, as long as there is no current, the true and dead reckoning places will coincide, and there will be but one line on the chart; but the instant that a current begins to act, the true and dead reckoning places will be different, and consequently the lines will separate; and whenever the current ceases, there will again be but one line. These distinctions catch the attention at once; but the plan has this farther great advantage, that the line joining the dead reckoning place and the true place, at any given hour, will express correctly the direction and the set of the current, in the interval between the moment under consideration and the instant of the last preceding observation.*

* Example.—Let the ship's true place, on the first day, be assumed, as at A. Let a fresh departure be thence taken, and the next true place, or place by observation, be noted, as B. Let the ship's place, by dead reckoning, be noted at the same moment, as at C.

From the true place (A), let two lines be drawn, as A B and A C.



It is useful, in practice, to have the line expressing the true course distinguished in some way from those marking the dead reckoning courses; one may be a strong black line, the others dotted lines, or when a chart is much covered with tracks, it is useful to use differently coloured lines.

It is sometimes satisfactory to join the dead reckoning places and the true places by arrows, and then rub out the whole of the tracks; so that all which is essential, as far as currents are concerned, is retained; while all that is not, and which might tend to confuse, is removed.

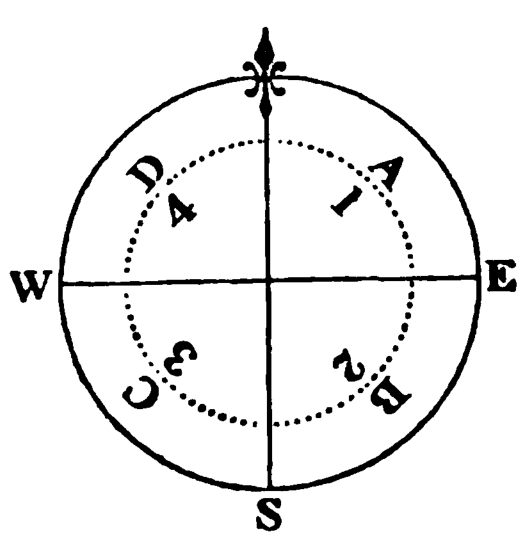
When one or more days elapse without an observation, the dead reckoning track may be carried on till an observation be obtained; and then the dead reckoning place and the true place at that instant being noted, a knowledge of the strength and direction of the current during the interval is at once afforded.*

It may be said that there is a fallacy in supposing the places, as laid down from chronometers and lunar observations, to be the true places; to which I would answer, that although it is not strictly the *true* place, it is generally not far from it, and for all practical purposes it may be so considered, because the object is to ascertain the difference between the true path and the dead reckoning path, from day to day; and it must be a very bad chronometer that will not give this within an inconsiderable quantity. Thus a chronometer, which might give the longitude half a degree wrong at the end of an Indian voyage, would serve very well to estimate the daily effect of the current off the Cape of Good Hope, within half a league of the truth.

It is clear, that to a ship navigating without a chronometer or lunars, the above method is of no avail; even if frequent lunar observations be taken, still it is not possible to make the required comparison, from day to day, without chances of great error; whereas, by means of a chronometer (aided, as it may very readily be, by lunars), nothing is so simple.

In this age of science, of general intelligence, and of liberality in everything connected with mercantile enterprise, it is indeed most astonishing that any ship should ever be permitted to set out on a voyage without a chronometer: and owners of ships, independently of the fearful responsibility which they incur, by neglecting so important a precaution, may be assured that they most materially neglect their own interest by this species of economy; for the safety of a ship is not only greatly lessened, but the voyage, in nine cases in ten, materially protracted by the want of this easy and cheap addition to her equipment. Not only, therefore, the high obligation which they are under to preserve as far as in them lies the lives of people embarked in their service, but their own obvious pecuniary advantage, calls upon them to despise this paltry saving, and never to suffer one of their ships to leave port, without being provided with an instrument often of as much value as either sails or rudder.

V.—BRIEF MODE OF EXPRESSING THE POINTS OF THE COMPASS.



THE Spanish navigators, in describing courses, &c., commonly make use of the expression, "*Rhombs of the first, second, third, and fourth quadrant;*" or winds of the same. The first quadrant, in this expression, is that contained between *North* and *East:* the second, from *East* to *South;* the third, from *South* to *West;* and the fourth, from *West* to *North.*

The respective quadrants may be represented algebraically by the letters A, B, C, D, as in the annexed figure; and, in keeping a journal, the points of the compass, or courses and bearings, may be expressed briefly, by adopting these letters

The difference, C B, thus shows the error in dead reckoning, which may be the effect of current.

From B, the ship's true place on the second day, the ship's true place on the fourth day may have changed to D; while E represents her place, by dead reckoning, on the third, and F on the fourth day, &c.—ED.

* This paper was originally communicated to the public through the medium of the *Edinburgh Philosophical Journal.* For a plate to illustrate the facts which it describes, see the Second Volume of that valuable work, page 279.

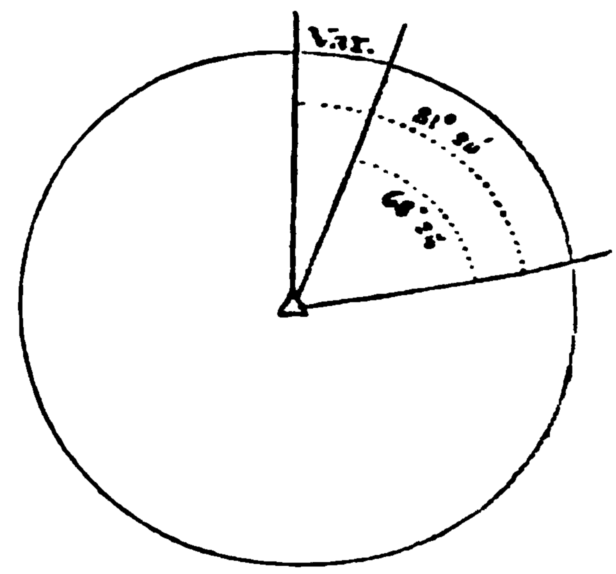
as the representatives of the four quadrants: thus N.W. by W. ¾ W., or five points and three-quarters from the North toward the West, will be concisely expressed by D 5¾; N.E. will be A 4; S.E. by E., B 5; and S.W. by S., C 3; &c.

So, likewise, by reckoning in degrees of the quadrant, N. 50° E. will be A 50°; and in allowing for magnetic variation, say, 24° W.; this added will be A 74°, the compass bearing, &c. Should a true bearing be N. 76° E., adding 24°, the variation, will give 100°: deduct 90°, and this gives E. 10° S., or S. 80° E., or B 80°, the bearing by compass.

But that the figures for points may never be mistaken for degrees, it may, perhaps, be best to express the latter in the usual manner, as N. 50° E.

VARIATION OF THE COMPASS BY PROJECTION.

The readiest way of understanding this subject is to project every azimuth and amplitude when it is taken. If this be done properly, no confusion will remain, after a few observations. An example will best illustrate this.



Say,—latitude 0° 38′ N.; declination, 21° 32′ N.; magnetic azimuth, E. 81° 20′ N.; true azimuth, E. 68° 24′ N. In the first place, assume a point Δ, which call the observer's eye; and another O, which call the sun: join these two, and from the eye, as the angular point, lay off the magnetic azimuth= 81° 20′; then, from the same line, Δ and O, and from the eye Δ, lay off the true azimuth=68° 24′, the difference of these two angles is the variation,= 12° 56′.

VI.—ON MAGNETISM AND THE COMPASS.

At the present time, when so much attention is directed towards the subject of magnetism, a few words on the present state of the science, and of its theory in general, will be, perhaps, thought useful. It would be impossible, in these very narrow limits, to embrace any large portion of the multifarious phenomena of the "difficult problem of the earth's magnetism;" and we must, therefore, confine our observations to the principal points.

Concerning the history of the magnetic needle, we have many and vague notices of its high antiquity. It is mentioned by Homer and Aristotle and by many subsequent classical writers, although it does not appear that it was, in any way, applied to the purposes of navigation; the first account we have of this is, that it was known, in Europe, at the time of the crusades, in about A.D. 1150, and it is very probable that the knowledge was derived from the Arabians, during those expeditions. But the Chinese were acquainted with it many years before this. We are told by the Jesuit missionary, Du Halde, that the Chinese emperor, Hoang-ti, possessed an instrument which pointed to the South, so early as the year 2,634 B.C., or 4,479 years ago; the same author gives subsequent notices of the compass in China, proving its very great antiquity among that people.

It has usually been considered that Columbus, in his voyage from Portugal, on the discovery of America, first observed the variation of the needle from the true North, or that it no longer pointed in the direction of the polestar; which discovery so alarmed the crew, that they mutinied and refused to proceed; but Columbus reassured them, and they again went forward. On his return, his statement of this change in the direction of the compass was not believed, and it was not fully established for nearly 60 years after. But, it is not improbable, that the variation was discovered nearly 200 years before Columbus made this change known, as it is mentioned in one of the earliest treatises on magnetism by Peter Adsiger, in 1269: the authenticity of this, however, is doubted by some. The wonderful property of the *dip* of the needle was first observed by our countryman Robert Norman, a maker of compasses, in 1576. Having made many compasses, and having balanced the needles previous to magnetizing them, he found that the North point invariably pointed below the horizon, and required balance-weights to keep it horizontal. He was induced to measure the quantity of this inclination by experiment,

and found that the greatest angle with the horizon, or the dip, was 71° 50′. It will be unnecessary to trace the subsequent progress of the science, the numerous and vague theories proposed, or the imperfect experiments made, the deductions of the magnetic intensity by Coulomb, or of the many experiments and conclusions, on the same subject, made by Sir I. Newton and David Gregory; we have merely to deal with the science, briefly, in its present condition.

Magnetism is a principle which is evidently a modification of, if it is not identical with, electricity and galvanism. For, in the causing any or either of these principles to become evident to our senses, we produce, at the same time, the others; and it may be here stated, that five apparently dissimilar effects are inevitably caused in the production of either: these are—light, heat, chemical action, electricity, and magnetism. By the production of *light* we cause heat and chemical affinity, and these will also produce *electricity*, and will cause the magnetic needle to swerve from the meridian. By the electric fluid we produce *light*, *heat*, and the other phenomena; and the magnetic needle is a measurer, by its deflections, of the most minute portions of galvanism. From the *magnet*, a spark can be produced, absolutely similar, in appearance and effect, to that of electricity and galvanism. There is a positive and negative state of electricity and galvanism; and there is a positive and negative, or North and South, pole to the magnet, and these attract or repel each other.

There is one phenomenon connected with these sciences, of very great importance in practice, and that is, that of *induction;* a substance electrified *positively* will *induce* a state of *negative* electricity, or will cause a body to be negatively electrified, that is within its influence; the North pole of a magnet will induce an opposite pole in that of another piece of iron, in certain positions with respect to the magnetic meridian and itself. Thus, the iron employed in the construction of a ship, or contained in its cargo, may all become, by *induction*, temporary magnets, and have a most marked and important effect upon the compass, by which it is steered; and it is this cause, which is too frequently overlooked, —that of the local deviation,—which has caused enormous errors in reckoning, and, consequently, the loss of many vessels. As scientific detail is out of our province, we must refer the reader to those works more expressly treating on the subject.

Terrestrial Magnetism.—The magnetism of the earth, by which the direction, the dip, and the intensity of the force of the magnetic needle is controlled, is still involved in much obscurity, and no very satisfactory system or theory has hitherto been framed, to account for the multifarious changes and phenomena of the compass needle. Among the more modern inquirers into the source of this most wonderful principle are Professor Hansteen, Mr. Bain, Mr. Barlow, Mr. Christie, Colonel Sabine, and many others. From their labours we have arrived at a tolerably correct notion of the *general effects* of magnetic phenomena; and, from these, the laws by which they are governed have, in some measure, been deduced.

Now, the most reasonable supposition is, that the earth itself is a magnet, or that magnetic currents exist on its surface, in certain directions, causing the various deflexions of the needle; whether this magnetism is *induced* from the sun, or other source, or whether the earth is in a positive and permanently magnetic state, does not affect the present question. From certain changes in the compass, perhaps it might be inferred, that the magnetism is *induced* by temperature (heat) from the sun; or that the ferruginous portions, which enter so largely into the composition of the earth, have received an inductive magnetism from the same source.

The discovery of two poles, of maximum cold, on opposite sides of the North pole of the earth, which was announced by Sir David Brewster, in 1820, led him, and other authors, to the opinion, that there might be some connexion between the magnetic poles and those of maximum cold. These two poles of maximum cold, which will likely perform an important part in the future history of terrestrial magnetism, are situated, according to Sir David Brewster, from the best observations made near and at a distance from them;—the American pole, in lat. 73° N., lon. 100° W., a little to the East of Cape Walker; and the Asiatic pole, in 73° N., lon. 80° E., between Siberia and Cape Matzol.

In 1683 Dr. Edmund Halley published a theory of magnetism, in which occurs the following ideas:—that the earth's magnetism was caused by *four piles or points of attraction*, two of them near each pole of the equator; and that, in those parts of the world which lie nearly adjacent to any one of those magnetic poles, the needle is governed thereby, the nearest pole being always predominant over that more remote. This view

of the earth's magnetism has been supported by the results of the labours of Professor Hansteen, one of the chief promoters of the science. From his most valuable work (*Magnetismus der Erde*, Christiana, 1817), his views may be learned. Having collected all the observations of value that had been made on the variation of the needle, he proved that there were *four points* of convergence among the lines of variation: viz., a weaker and a stronger point, in the vicinity of each pole of the globe. This, combined with the result of Sir D. Brewster's inquiries, before stated, will certainly lead to the view of the connexion between the heat of the earth and its magnetism. Professor Hansteen considers, that the strongest poles, N.S., lie almost diametrically opposite to each other, and the same is true of the weaker poles *n.s.* These four poles he found to have a *regular motion* obliquely; the two northern ones N.*n*., from West to East, and the two southern ones S.*s*. from East to West. The following he found to be their periods of revolution, and their positions in 1830:—

	Lat.	Lon. from Greenwich.	Time of revolution round each pole of the earth.
Pole N.	69° 30′ N.	87° 19′ W.	1,740 years.
Pole S.	68° 40′ S.	131° 47′ E.	4,609 —
Pole *n*.	85° 6′ N.	144° 17′ E.	860 —
Pole *s*.	78° 29′ S.	137° 45′ W.	1,304 —

From calculations, based upon subsequent observations, he slightly varied these positions and periods; but he has shown, very clearly, that the changes in the variation and dip of the needle, in both hemispheres, may be well explained by their motion. He also calculated the positions of these poles, for the periods between 1800 and 1850. At the last period, the pole N. will be in lat. 69° 14′ N., lon. 83° 10′ W.; the pole S., lat. 68° 29′ S., lon. 130° 14′; pole *n*., lat. 85° 0′ N.; lon. 152° 40′ E.; and pole *s*., lat. 78° 54′ S., lon. 143° 16′ W. It may be here remarked that Commander Sir John Ross, in the Arctic Expedition of 1831, erected a flag upon the magnetic pole (strongest North pole, or pole N.) in 70° 5′ 17″ N., and lon. 96° 45′ 48″ W., a discovery which coincides strikingly with Hansteen's result.

These four magnetic poles, or points on the earth's surface, over which the dipping-needle would stand vertical, are separated by a magnetic equator, which is not coincident with the earth's equator, but is an irregular circle, which crosses it in three points, according to M. Duperrey, or in four points, according to M. Biot and Professor Hansteen; on this circle, of course, the dipping-needle stands horizontal.

Respecting the North Atlantic Ocean, we may here state, that the magnetic crosses the terrestrial equator in about lon. 20° E. (in the Bight of Biafra), and proceeds westerly across the Atlantic, to the coast of Brasil, which it touches in lat. 16° S. The line of equal dip, at 70°, runs from the Bristol Channel, curving S.W. and W., to about Charleston, U.S.; between these lines, the lines of equal dip (or *Isoclinal lines*) form regular divisions.

Professor Barlow, of Woolwich, one of the chief contributors to magnetical knowledge, has proved, that most of the magnetic phenomena may be shown, in degree, on iron spheres or shot; a large range of experiments on which he undertook, the important results of which are before the world. If a shot or iron sphere,—for it matters not for the density, so that its thickness exceeds one-thirtieth of an inch, and perfectly free from permanent magnetism,—if this shot is placed on an horizontal line, the line which would divide it into two hemispheres, which may be marked by a thread, and placed *parallel to the dip* of the magnetic needle; these hemispheres will, by the inducted magnetism from the earth, affect the compass in the same manner as the different magnetic changes on the surface of the earth. When we consider that a similar effect is exerted by every particle of iron in a ship, and that not in proportion to its weight, but its surface and position, it may be very readily understood how such large errors of dead-reckoning, as sometimes occur, may be attributed to local deviation or attraction.

Among the other causes of disturbance to the compass, the Aurora Borealis appears to have the greatest effect of all natural phenomena, and it has been inferred from this, that it is a magnetic effect in itself; but the amount of aberration it occasions is comparatively minute, and, in ordinary circumstances, would not be noticed.

Electricity has also a marked effect on the needle, as detailed on p. 547.

In the researches of Mr. Barlow, that gentleman found that iron was not the only substance which could be rendered magnetic, but that almost every substance acquired some portion of the influence which was capable of acting on others. And Mr. Snow Harris

has measured the comparative susceptibility of different substances, of which he has given the following table, which may be considered, however, as only an approximation:—

Rolled silver ...	39	Cast zinc	10	Fluid mercury. .	1	Marble.........	0·37
——— copper...	29	—— tin	6·9	Cast antimony. .	1·3	Freestone......	0·36
Cast copper......	20	—— lead	3·7	—— bismuth...	¼	Mahogany ...	0·37
Rolled gold.....	16	Solid mercury...	2	Glass	0·35	Water	0·27

So that the whole fabric of a ship, in addition to the iron used in its construction and fittings, must exert a magnetic influence on the compass. Colonel Sabine, in a recent investigation of the Antarctic Magnetic Expedition (British Association, 1844), infers that it is probable, in all sailing vessels, there is little or no appreciable amount of *permanent* magnetic polarity (though in steamers, or iron ships, the case may be otherwise), but that the whole of the *transient* polarity *induced* in the iron by the earth's action, at any given moment and locality, is not *instantaneously* destroyed and exchanged for a new magnetic state, on a change of geographical place or angular position, though the greater part of it is so. A residual polarity lingers, as it were, in the iron of the ship, and fades out more slowly, so that the vessel carries with it, into every new point of its course, some trace and impress of the terrestrial magnetism of those which it has just left.—*Report, &c.*, p. 143.

The mariner's compass, as generally used, exhibits the direction of the magnetic meridian only; but, in treating of the magnetic needle, three points are to be inquired into: these are, the variation, or *declination;* the dip, or *inclination;* and the *intensity* of the magnetic force: and to the elucidation of these the philosophers in all quarters of the globe are at present engaged.

The Declination, or Variation.—With this branch of the subject every sailor is perfectly familiar, and any comment on its actual state is therefore unnecessary. But this variation is not constant. There are several elements of change in this part of the magnetic force, for it undergoes secular, annual, mensual, diurnal, and also irregular changes. The *secular* change is a progressive alteration, observed in the direction of the magnetic needle during a series of years. Thus, in 1576, Robert Norman found the compass at London to point 11° 15′ *East* of North; in 1658, it pointed true North; it was on the increase to 1819, when it was 24° 41′ *West* of North; and since then it has been retrograding, and is now (1845) 23° 18′ W.

The *mensual* change is according to the season of the year. It was first noticed by Mr. Canton, about the year 1756. It amounted, in January, to 7′ 8″; in March, 11′ 17″; in June, 13′ 21″; in September, 11′ 43″; and in December, 6′ 58″. These are the diurnal changes, which vary in amount in different parts of the year.

The *diurnal* change is thus given from the recent observations of Professor Lloyd:— "The mean daily curve of the changes of declination, for the entire year, exhibits a small easterly movement of the North end of the magnet during the morning hours, which reaches its maximum about 7h a.m. After that hour the North end moves rapidly westward, and reaches its extreme westerly position at 1h 10′ p.m. It then returns to the eastward, but less rapidly, the easterly deviation becoming a maximum about 10h p.m.; the mean daily range equals 9·3′."

The *irregular* changes, or magnetic storms, as they have been termed, occur without any previous notice, and are of very great extent; some of them have been traced almost throughout the globe. At times this deviation amounts to 2°.

As the ascertained variation of the compass, in various parts of the Atlantic, are attached to the Tables of Positions, in the former part of this work, we refer the reader to them for the results of these observations.

The Dip, or Inclination.—The dip of the needle, as we have already had occasion to observe, is the angle which a well-balanced needle forms with the horizon, after it is rendered magnetic, and when it has the power of free motion in the plane of the magnetic meridian. As before stated, this angle varies in different parts of the globe, being at zero on the magnetic equator, and 90° on the magnetic poles. The dip, like the variation, undergoes a continual change, increasing in some parts of the world and diminishing in others. Thus, at Paris, in 1761, it was 75°; in 1829, only 67° 41′. At London, in 1576, it was 71° 50′; in 1837, it was 69° 20′; in 1843, it was 69°. The dip is a very important element in magnetic consideration, and is too much overlooked by the sailor. The instruments for its measurement, however, are expensive and delicate, and require great

nicety in their management; for these reasons, it is comparatively neglected; but as it is in some degree a measurement of the intensity of the magnetic force, and also greatly modifies the directive power of the compass, it is very important to the mariner. When the needle is perpendicular, of course its directive force vanishes, although at that time the intensity of the magnetism is greatest. The diurnal change in the dip amounts to 3′ or 4′, and is also about 15′ greater in summer than in winter.

The following table gives the result of some of the more recent and careful observations that have been made for ascertaining the dip in various parts of the Atlantic. We have extracted it from one by Major Sabine, in the *Philosophical Transactions*, 1840, p. 135.

Place.	Dip.	Observer.	Year.	Place.	Dip.	Observer.	Year
Montreal	76° 19′*	Estcourt	1839	Cape Gracias a Dios	41° 4′	Barnett...	1833
Halifax	74 45	Estcourt	1838	Curaçoa	38 39	Zarhtman	1833
Worcester	74 21	Loomis...	1839	Caraccas	37 16	Home ...	1836
Cambridge	74 20	Loomis...	1839	St. J. de Nicaragua	34 43	Barnett...	1839
Springfield	74 11	Bache ...	1834	Demerara	33 57	Home ...	1837
Providence	74 0	Loomis...	1839	Chagres...........	32 30	Home ...	1834
Hartford	73 58	Loomis...	1839	Pará	24 8	Home ...	1835
New Haven	73 27	Loomis...	1839	Bahia, Brasil ...	5 1	Sulivan...	1839
New York	72 52	Loomis...	1839	Rio Janeiro	13 0†	Sulivan...	1839
Washington	71 21	Loomis...	1839	London	69 20*	Mag. Surv.	1837
Bermuda	67 31	Home ...	1837	Terceira	68 6	FitzRoy	1836
Nassau	56 13	Barnett...	1839	Paris	67 24	Arago ...	1835
Contoy Island ...	49 48	Barnett...	1838	Tenerife	57 47	Wickham	1837
St. Thomas	49 29	Zarhtman	1834	Port Praya	45 46	FitzRoy	1836
Antigua...........	48 46	Home ...	1835	Egga, on the Niger	13 51	Allen......	1833
Alta Vela	47 39	Home ...	1835	Fernando Po......	0 48	Allen......	1833
Jamaica...........	47 19	Barnett...	1834	Ilha das Rolas ...	7 44†	Allen......	1833
Barbadoes.........	43 37	Home ...	1835				

The Intensity.—The intensity of the magnetism of the earth varies also with time and place. It is the power of the earth to bring an oscillating needle to a state of rest; and it is in proportion to the squares of the number of vibrations per second. The lines of equal intensity would, at first, seem to coincide with those of equal dip, but, in consequence of the double magnetic polar axes, they differ in their relation, though they still form regular and symmetrical curves. As the magnetic latitude increases, so does the intensity, but not the directive force; for, when a needle is on the magnetic equator, it naturally preserves its horizontality, and, consequently, the whole of its magnetism is employed in directing the needle towards the poles. But, in high magnetic latitudes, where the dip is great, the means employed to keep it parallel with the horizon, of course reduce very considerably its power of keeping in a North and South direction; and in the circumpolar regions the ordinary compass becomes so sluggish as to be of but little value to steer by.

The method employed to ascertain the amount of intensity is by observing the number of oscillations made in a given time, by the *same* needle in different parts of the world. It is to Professor Hansteen that we are mainly indebted for the first ideas upon this branch of magnetism.

Having thus very briefly sketched the general phenomena of terrestrial magnetism, the reader will understand the general principles laid down by Dr. Halley and Professor Hansteen, that in the northern hemisphere the two points of convergence of the magnetic variation, or declination, by revolving around the pole of the earth, will cause a local change in the variation of all places lying in North magnetic latitude, and which, in the case of London, has amounted to 35½° in 465 years. The dip, on the other hand, has changed but little, or 2½° in 260 years; this is obvious, because the two magnetic axes, while they change their terrestrial longitude in a considerable degree, do not vary much in latitude, and, consequently, will not greatly affect the dip in places at some distance from them.

We shall now give a few remarks upon the local magnetism of a ship, and the effect of induction upon the compass, or, as it is termed, *local deviation*.

* North End. † South End.

The Local Deviation of the Compass is its variation from the magnetic meridian, which may be caused, as already noticed, from a peculiar state of the atmosphere, Aurora Borealis, lightning, or the local attraction of the ship, iron, &c. This is a subject of inquiry, which was first explained by Captain Flinders, in the description of his surveys of the Australian coast. To this subject his attention was directed, not only by some anomalous differences which he found in the compasses that he used, but by others recorded by Mr. Wales, who had accompanied Captain Cook in the capacity of astronomer.

Captain Flinders says:—Several instances have been mentioned, in the course of this voyage, where the compass showed a different variation on being removed from one part of the ship to another; thus, observations on the binnacle gave 29½° off the Start, where the true variation was about 25½° West; while others taken upon the booms, before the mainmast, 68 miles lower down Channel, gave only 24°; and, in experiments made with five compasses, the mean variation of the binnacle was 4° 37′ greater than on the booms. Finding that the situation of the compass was an object of importance, I determined very early in the voyage to place it always upon the binnacle, both when taking bearings for the survey, and when observing azimuths or amplitudes; nor, in any observations taken by myself, was it ever displaced, except by way of experiment: but the officers occasionally observed from different parts of the ship, when the sun could not be seen from the binnacle, until they were convinced that such observations were of no utility, either to the survey, or for ascertaining the true variation.

It soon became evident, however, that keeping the compass to one spot was not sufficient alone to ensure accuracy; a change in the direction of the ship's head was also found to make a difference in the needle; and it was necessary to ascertain the nature and proportional quantity of this difference before a remedy could be applied. This inquiry was attended with many difficulties, and no satisfactory conclusion could be drawn until a great variety of observations were collected: it then appeared, that when the ship's head was on the eastern side of the meridian, the differences were mostly one way, and when on the western side they were the contrary; whence I judged, that the iron in the ship had an attraction on the needle, and drew it forward; but there was this remarkable distinction in the northern atmosphere,—it was the North end of the needle which was attracted, and, in the southern hemisphere, it was the South end. In the instance off the Start, before cited, when the ship's head was West, the North end of the needle had been drawn forward, or to the left of North nearly 4°, and the West variation thereby increased to 29½°; with the head East, it would be drawn to the right of its natural position, and the variation diminished to about 21°; but, at North, the attraction in the ship was in the same line with the magnetic poles of the earth, and would, therefore, produce no change. The same thing took place at South, for the two attractions were still in the same continued line, though on opposite sides of the compass; and throughout the voyage I found that variations, taken with the head at North and South, agreed very nearly in themselves, and with the observations on shore, near the same place, when such observations were not affected by local attractions.

But, although the errors were always the same way in the same hemisphere, when the head was at West, and when it was East they were always the contrary, yet the quantities varied with the situation of the ship, being greater in high and less in low latitudes; and yet they did not increase and diminish in proportion to the latitude. After much examination and comparison of the observations, and some thinking on the subject, I found that the errors had a close connexion with the *dip of the needle*. When the North end of the needle had dipped, it was the North point of the compass which had been attracted by the iron in the ship; and, as that dip diminished, so had the attraction, until, at the magnetic equator, where the dipping needle stands horizontal, there seemed to be no attraction. After passing some distance into the southern hemisphere, and the South end of the needle dipped, our observations again showed errors in the compass; but the West variation was now too great when the ship's head was eastward. These errors increased as the dip augmented: and in Bass' Strait, where the South dip is nearly as great as the North dip in the English Channel, the attraction produced almost as much error as when we left England, but it was of an opposite nature. On turning northward again, along the East coast of New South Wales, the dip of the South end of the needle, and the attraction of the iron upon the South point of the compass, diminished together, as nearly in equal proportions, as the accuracy of our observed variations could be depended on; and I, therefore, considered the connexion between them to be so far certain as to make the dip one *datum* in reducing the observed to the true variations.

Another point of equal importance remained to be known: the compass stood right in both hemispheres when the ship's head was at North or South, and erred most to one side when the head was West, and on the other when it was at East; but what was the proportion at the intermediate points between the magnetic meridian and East and West? Unfortunately, the direction of the ship's head, when observations were taken, had not been particularly marked in the first part of the voyage, nor always in the latter part; and, in gathering it from the courses steered when under way, and from the direction of the winds and tides when at anchor, there was often a good deal of uncertainty; but it was evident that the quantity of error increased as the angle between the ship's head and the magnetic meridian became greater. After some consideration, it appeared to me that the magnetism of the earth (inductive magnetism) and the attraction forward in the ship must act upon the needle in the nature of a compound force, and that the errors produced by attraction should be proportionate to the *sines* of the angles between the ship's head and the magnetic meridian. I tried this upon many observations, where the direction of the head was least doubtful, and found the differences to correspond as nearly as could be expected, and sometimes exactly; it therefore seemed probable that *the error produced, at any direction of the ship's head, would be to the error at East or West, at the same dip, as the sine of the angle between the ship's head and magnetic meridian was to the sine of eight points, or radius.* According to this, when the error was ascertained at any given direction, more especially at East or West, where it was greatest, it might be found at any direction required, by inspection in the Traverse Table.

It is not possible to lay down any rules for the *amount* of local deviation in any particular ship, as in every case there must be a different amount of local attraction and repulsion, which will vary, not only with the situation of the vessel, but also with any change in her cargo, trim, and even her inclination, while sailing, or otherwise. This must be ascertained by actual experiment. "It is possible," says Lieutenant Raper, "mathematically speaking, to lay down rules for reducing the local deviation observed at any one place, to a place in any other magnetic latitude, and also for calculating the effects produced by the inclination of the ship upon the local deviation itself. Such rules, however, demand the knowledge of certain elements, which in ordinary observations of the kind, made with so rude an instrument, cannot be determined with the requisite precision. The rules, moreover, besides being too complicated for general use, are necessarily deduced upon the express condition that the deviation at N. and S. is 0°: whereas observation almost always shows a considerable deviation, as 1° or 2°, at these points, and thus, contradicting the assumption, renders the rules uncertain. Supposing, however, all these obstacles, together with the disturbing effects of partial magnetism, removed, a small change in the position, or quantity of iron, may affect the compass sensibly, and thus render the rules erroneous. Commander Johnson, in his experiments on an iron steamer (*Phil. Trans.*, 1836), found an alteration of 5° 20′ on a compass near the binnacle, from the circumstance of merely swinging the quarter boat's (iron) davits on board, as if for securing the boat for bad weather.

"The remarks above laid down on local attraction will, it is presumed, give the seaman all necessary information on the subject. Much has been said on the necessity, as well as on the mode, of discovering the amount of local deviation; but the determination would seem, after all, of doubtful utility, at least as regards ordinary navigation, for consistency demands that if we once enter upon such corrections, we must be prepared to undertake every collateral calculation, which of course, as concerns daily practice at sea, is entirely out of the question. A little attention will discover any important deviation, which will be allowed for on the *entire variation* itself.

"This, at least, is my own impression; but it is just to state that many of those who are conversant with the subject of magnetism are of the contrary opinion, and consider that the local deviation should be, in all cases, separately deduced."—*Practice of Navigation*, p. 47.

A few words on the mariner's compass will form a fitting conclusion to the foregoing remarks. The magnetism in a needle is found to be concentrated towards its extremities; in the centre the proportion of its entire magnetic energy is but small, and it increases very rapidly towards the poles of the magnet. It has been stated that the proper proportions for a magnetic needle are, that the length should be ten times the breadth. A powerful compass should have but little weight, and possess great magnetic energy, and have but little friction on the point of suspension. All these qualities are, perhaps,

seldom united in the common compasses, but they are not incompatible. Small magnetic needles possess greater magnetic force, *in proportion*, than large ones; and consequently the needle ought to have an exact proportion, in size and weight, to the compass card. A rule has been given, that a needle in a steering compass is of sufficient strength, when it will support by its magnetism a similar card and needle; and that it should not weigh more, when complete, than 1,000 grains, nor less than 800. The steel should be *hard*, so that the magnetism should be of a *permanent* character.

The usual mode of balancing the needle, so as to overcome the dipping tendency, is to have a moveable weight attached to the needle; this brings the point of gravity on one side of the point of suspension. This being the case, of course every lurch and heave of the ship will swing round this heavier side, and cause unsteadiness in the card.

One evil, that has not yet been entirely overcome in the construction of compasses, is the length of time that a delicately suspended needle will vibrate, after having been deflected, before it comes to the meridian. A multitude of contrivances have been proposed to obviate this, but they all fail in this—that by rendering the needle less sensible to external force, the accuracy and performance of the compass are also impeded.

Mr. Walker, R.N., has proposed a mode of suspension which will obviate, in some measure, this tendency to vibrate. He places upon the ordinary vertical spindle, rising from the bottom of the compass bowl, a cone of brass, on the apex of which the steel pivot is placed on which the compass card revolves. The card has thus a double suspension. The cone is not a magnetic body, and its centre of gravity is directly under the point of suspension. Now, if a rotatory motion be communicated to the cone, it will have a tendency to go on in the same direction. But the needle on its pivot above the cone, if it is deflected, will *vibrate;* and it is evident that in one direction its course will be in opposition to that of the cone, which will therefore retard the oscillations of the magnetic needle, and bring it sooner to rest. Besides this arrangement of the suspension, Mr. Walker has fitted a compensation regulator beneath the compass needle: this will obviate the imperfect contrivances of having the weight more on one side of the point of suspension than the other. These arrangements have been executed by Mr. E. J. Dent, who has also constructed a compass on a perfectly new principle; he suspends the needle in the same manner as the balance of a chronometer, by means of a pivot through the needle, both ends of which act on jewelled centres. This is a very delicate mode of suspension, and will entirely avoid the necessity of balance or compensation weights. Another advantage to be gained by this is, that the card can be *reversed*, and thus the errors arising from the non-coincidence of the magnetic and maker's axes of the needle will mutually compensate each other. Such a compass, if the pivot is exactly *vertical*, will move in an horizontal plane; if it is placed horizontally, it will become a dipping needle; and any position between these will cause the card to take a direction compounded of the variation and the dip. The mode of adjusting these compasses, however, will preclude any great error on this point.

In consideration of the defective state of the navy compasses, a committee was appointed for their improvement. They have caused the introduction of a class of new and costly instruments as standard compasses, one of which will be placed in each of the ships belonging to the navy. Some of these very superior and powerful instruments have as many as eight magnetic needles laid parallel to each other, and they will show the most minute changes in the magnetic condition of the ship.

Compasses in use should not be placed within 2 or 3 feet of each other, on account of the mutual effect they will have on the bearings shown by them; and, it need scarcely be remarked, that all iron should be removed as far as possible from them. This is, perhaps, a difficult point, considering how largely iron enters into the construction of modern ships. This point has engaged much of the attention of men of science, and the means proposed for overcoming this local attraction, by counterbalancing forces, are various. For iron ships, it has been proposed by Professor Airy, the Astronomer Royal, to have powerful magnets so arranged, as to neutralize the effects of the attraction of the vessel; but the subject is fraught with difficulty, and, under any circumstances, but little dependence can be placed on compasses in vessels so constructed.

One of the most generally useful compensators for this unequal attraction is the invention of Professor Barlow, next described.

Mr. Barlow's Correcting Plates for the Compass.—"Since the action of any mass of iron, or system of iron bodies, may be referred to two points, indefinitely near to each

other, in the general centre of attraction of such mass or system, it follows that, in a ship, all the action may be referred to a fixed point in the vessel, and that the line joining that point, and the pivot of the needle, will be fixed in position, as regards the ship, in all parts of the world; and, secondly, since the whole magnetic power of iron resides on its surface, it is easy to procure a plate of iron, of inconsiderable weight, that shall have, when placed near the compass, an effect upon the needle equal to the great mass of iron in the vessel, situated at a greater distance; and if, also, the centre of attraction in this plate be placed in the line above mentioned, then, in whatever direction the vessel is placed, or in whatever part of the world the observation may be made, the plate will always produce a disturbance on the needle equal to that of the ship; so that, by obtaining the one by observation, the other, that is, the disturbance produced by the ship, becomes known. Hence, whatever may be the law by which this disturbing power is governed, or whatever may be the dip of the needle, or the direction of the ship's head, the plate and the iron of the vessel attract the needle the same, both in quantity and direction, and the one becomes known by the observation made on the effect of the other.

"Upon this principle a *circular plate of iron*,* *for counteracting the effect of aberration*, has been contrived by Mr. Barlow. The proper situation for this plate, or neutralizing force, is to be found by experiment; and, in order to attain this situation, a place must first be selected for the azimuth or regulating compass to be fixed in, for observation during the period of the ship's being in commission. It will then be necessary to ascertain the local attraction of the vessel, which may be done in the following manner:—

"The ship being moored, or lying with a short scope of cable, must have anchors so arranged as to admit of her head being directed to each point of the compass successively, and there steadied, whilst the bearing of a remote object is taken (the more distant the better), to avoid the parallax, which would otherwise affect the observations. It will then be found that the bearings, thus observed, differ from each other, according to the attractive power of the vessel, from 6° or 8° to 26° or 28°; a difference which is caused by the iron of the ship attracting the needle out of its proper direction, to the eastward with the ship's head to the East, and to the westward with the head to the West.

"On examining these several bearings there will be found *two*, at opposite points of the compass, that will nearly agree with each other, the mean of which must be accounted the correct magnetic bearing of the object; and these points will also indicate the line of non-attraction in the vessel, and which will generally be found nearly fore and aft: in this line the plate is ultimately to be fixed.

"By comparing the correct magnetic bearing, as before found, with the observed bearing at the several points, the amount of the local attraction, at each point, will be ascertained.

"It now remains to determine the position of the plate in which it will correct the deviations. This will now be readily done by means of a small table, which Mr. Barlow intends to supply with every plate for that purpose. In this table will be found a variety of local attractions, comprehending all possible limits for every class of vessels, and in which will be found those of the vessel in question, corresponding to which will be found two numbers; one being the distance of the centre of the plate below the pivot of the needle; and the other, its distance from the plumb-line passing through the same; at this depth and distance, in the line of non-attraction already mentioned, the plate must be fixed abaft the compass, in which position it will be found to correct those deviations caused by the great mass of iron lying before the compass; so that, if the vessel is swung, no discrepancies will be found in the bearing of any object in this or any other part of the world."

The importance of this principle of correction has been amply demonstrated in several voyages. It is one of those valuable discoveries which have originated, not in mere chance, but from rigorous and scientific investigation; and it has been appreciated accordingly. The Board of Longitude has expressed its opinion, by conferring on Mr. Barlow the largest premium (£500) allowed by the late Longitude Act; at the same time stating, that this sum is not to be considered as any remuneration for the time and expenses bestowed upon the inquiry, which is recommended to be considered, by the Navy and Admiralty Boards, as distinct from the above reward. The Honourable Board of Trinity House has complimented the Professor with £200, and the East India Board

* Or several parallel plates screwed together.

with a similar sum. It has been announced, that Admiral Krusenstern has written to Professor Barlow a very satisfactory and complimentary letter, on the result of experiments with the plate, made in a ship of the Imperial Navy at Cronstadt; and the Russian government, in consequence, has given orders for all its ships to be furnished with correcting compass plates, similar to those fitted to the British ships. A valuable gold watch and rich dress chain have been presented to Mr. Barlow, from the Emperor Alexander, as a mark of the imperial approbation, and a deserved acknowledgment of his merit, &c.

VII.—ON THE GENERAL TEMPERATURE OF THE SEA; MARINE THERMOMETER.

According to the reasoning of Captain Sabine, the greatest density of sea-water, resulting from its temperature, takes place at about 42°; that is, if above or below, it will rise above the strata having that temperature. He also considered that this mean heat on the surface of the ocean would be found somewhere between the parallels of 65° and 70° N., and at the depth of 1,200 fathoms, in lat. 20¼° N., as stated hereafter in his experiment. But, however, we apparently know but little of this subject, for theory is not entirely borne out by practice. Captain Sir James Clark Ross, in his Antarctic Voyage, on January 3rd, 1842 (nearly midsummer), in latitude 66° 34′ S., the ships enclosed in a field of ice, without visible limits, let down a line of 945 fathoms, with attached thermometers, which, contrary to the received theory, showed a constantly increasing temperature from the surface at 36° to 39° 5′, Fahr. Similar results were obtained by Captain Scoresby; in lat. 79° 4′ N., lon. 5° 4′ E., at 400 fathoms, the temperature was 36°; at the surface, 29°: another, in lat. 79° 4′ N., gave 37° at 730 fathoms, with the surface at 29°: a third, at lat. 78° 2′ N., lon. 0° 10′ W., 38° at 761 fathoms, the surface being at 32°. On the other hand, Messrs. Bravais and Martins, July 20, 1839, in lat. 73° 36′, between Lapland and Spitzbergen, found a *decreasing* temperature from 42° 5′, at the surface, to 32° 2′, at the depth of 475 fathoms. This last, however, cannot invalidate Sir James Ross's conclusions, which afterward following up, he assumed that there was a zone in the southern hemisphere in the mean altitude of about 56° 26′, the water of which possesses the same unvarying temperature of 39° 5′ from the surface downwards. The waters to the southward of this belt or zone will be colder at the surface than beneath it, and towards the Equator they will decrease in temperature from the surface downward. Supposing, therefore, that a similar zone should exist in the northern hemisphere (which, nevertheless, is improbable, from the configuration of the land), the waters of the ocean would be separated into three thermic basins—two towards each pole of the earth, and a third through the central part of which the Equator would pass. In lat. 45° S., the temperature of 39° 5′ is only to be found at the depth of 600 fathoms, which is increased to 1,200 in the equatorial and tropical regions; the surface being 78°. In the South polar thermic basin the temperature of 39° 5′ is at the depth of 750 fathoms, the surface being at 30° Fahr.

Captain Horsburgh has said:—"The temperature of the sea is a phenomenon of nature hitherto but little investigated, although it appears to be closely united with the improvement of nautical science: the following observations may, therefore, be not altogether unimportant to navigators:—

"It has been thought that the temperature of the ocean was subject to little mutability, particularly between the tropics; but the temperature of the surface of the ocean is affected by changes of the superincumbent atmosphere, as well as by other local or adventitious causes.

"1st. When the atmosphere is cold, a portion of its temperature is imparted to the surface of the ocean, by which the temperature of the latter is diminished; and, in calm, settled weather, the maximum of temperature of the sea has been experienced about, on, or two hours after mid-day, and the minimum about sunrise in the morning.*

"2nd. Tempestuous weather raises the temperature of the sea, which is probably pro-

* By the experiments and observations of Dr. John Davy, during a voyage to Ceylon.

duced from the agitation or friction of the broken waves, by the particles of water rubbing against each other.

"3rd. *Currents have a more powerful influence than any other cause, in changing the temperature of the surface of the ocean*; so that, in either hemisphere, a current proceeding from the cold polar regions toward the Equator, diminishes the temperature of the sea; whereas a current running from the intertropical regions, toward either pole, raises its temperature."

How long the great body of a current preserves its general temperature has been shown already, in the description of the Gulf Stream, and will be more clearly shown in a subsequent part of this section.

"4th, and lastly.—The depth of the sea appears, also, to have a great influence on the temperature of its surface; for the immense body of water contained in the ocean preserves its heat; whereas in places of little depth, the surface of the water is cooled by the increased evaporation. The temperature of the ocean, therefore, ought to be higher than that of seas which have little depth of water, in the same parallels of latitude. This seems to be verified by the experiments and observations of Dr. Davy, during his voyage to Ceylon; as, in approaching the land of Table Bay, at the Cape of Good Hope, the temperature of the sea decreased 2°; and it also decreased 2°, when the Island of Ceylon was closely approached, although the bank of soundings does not extend far out from either of those places. Were the temperature of the sea, as well as that of the atmosphere, conjointly registered in the journals of navigators, several times during twenty-four hours, it would greatly assist the improvement of nautical science; and the proximity of land, or shoal-banks, might probably be ascertained, by carefully observing the temperature of the sea."

These remarks by Captain Horsburgh corroborate those already given in the preceding part of the present volume.

With respect to the temperature of the sea at different depths, it seems reasonable enough to suppose, that in summer-time it will be hotter at the surface than at any considerable depth below it, and that in winter it will be colder; this has been confirmed by many experiments.

Mr. Wales, who accompanied Captain Cook, has given the temperature of the sea, as found in different depths and places. His apparatus for trying the same consisted of a square wooden tube of about 18 inches long, and 3 inches square externally. It was fitted with a valve at the bottom, and another at the top, "and had a contrivance for suspending the thermometer exactly in the middle of it. When it was used, it was fastened to the deep-sea line, just above the lead, so that, all the way it descended, the water had a free passage through it, by means of the valves, which were then both open; but the instant it began to be drawn up, both the valves closed by the pressure of the water, and, of course, the thermometer was brought up in a body of water of the same temperature with that it was let down to." With this instrument, which is much the same with one formerly described by Mr. Boyle in his observations on the saltness of the sea, water was fetched up from different depths, and its temperature accurately noticed in different seasons and latitudes.

In the voyage to Spitzbergen, 1773, Captain Phipps made use of a bottle to bring up water from the bottom, which is thus described:—"The bottle had a coating of wool, 3 inches thick, which was wrapped up in oil-skin, and let into a leathern purse, and the whole enclosed in a well-pitched canvas bag, firmly tied to the mouth of the bottle, so that not a drop of water could penetrate to its surface. A bit of lead, shaped like a cone, with its base downwards, and a cord fixed to its small end, was put in the bottle, and a piece of valve leather, with half a dozen slips of thin bladder, were strung on the cord, which, when pulled, effectually corked the bottle on the inside."

On the temperature of the sea, as found on the late expeditions to the North, the following remarks have been made:—"A series of observations, on the temperature of the sea, at the surface and at certain depths, may serve to correct erroneous notions, which, it would appear, have prevailed on this subject. We have no doubt that they are the most accurate that have yet been made, and in deeper water than a self-registering thermometer had ever been sent down before in any part of the world. The result is very different from that of former observations. It seems, that in Baffin's Bay, the temperature, generally speaking, decreases with the depth. At 1,005 fathoms, in lat. 71° 24',

the temperature was 8½°, at the surface 36°; and, whenever the depth exceeded 100 fathoms, the thermometer generally descended to 30°, or below, when 34° or 35° at the surface. Near Cape Walsingham, it is stated, that, from the depth of 660 fathoms, the thermometer came up at 25½°; from 400, at 28°; from 200, at 29°; and from 100, at 30°; the temperature of the air being 37°. It would be difficult to explain why the sea remained in the state of water at 25½° of Fahrenheit. Did the pressure of the column of water prevent its freezing? or was the water more strongly impregnated with salt? These, and other observations, made in the course of this voyage, both on land and sea, are completely at variance with the theory of isothermal lines of temperature, which had been assumed, as it would now appear, from a too limited number of facts. But the most unaccountable circumstance is, that of the polar expedition having, in the seas of Spitzbergen, on the same parallels of latitude, invariably obtained a contrary result, the temperature of the sea increasing with the depth; so that when the thermometer, at the surface, stood at 32° or 33°, at 300 fathoms it was 36° or 37°. We pretend not to explain this singular anomaly; indeed, we do not conceive that we are yet in possession of a sufficient number of facts to enable us to reason on the subject."—*Quarterly Review*, No. XLI., May, 1819.

The following experiments will prove, that between the tropics, and in the temperate zones at sea, "when the temperature of the atmosphere exceeds that of the surface of the sea, the superficial water is *generally* warmer than at certain depths between it (we say generally, because, in soundings and confined waters, local causes effect many exceptions to this general rule); and, in all probability, the greater the depth, the colder the fluid in that case.

"On the 23rd of February, 1804, off Falkland Islands, in lat. 52° S., and about the longitude of 50° W., Admiral Krusenstern says, the temperature of the air was 59°; of the surface, 55°; and at the depth of 55 fathoms, 52°; the whole depth at the time being 75 fathoms. On the 9th of March, 1804, beyond Cape Horn, in lat. 50° 20′ S., and lon. 72° 45′ W., the temperature of the air was 41°; the surface of the sea, 39°; at the depth of 60 fathoms, 38°; and at 100 fathoms, 36°. On the 24th of May, in the Pacific Ocean, 56 miles South of the Equator, and in lon. 146° 16′ W., the temperature of the air, and the surface of the sea, were equal, at 83°; but that at the depth of 100 fathoms was 61°. On the 22nd of June, in a perfect calm, on the tropic of Cancer, in the Pacific, the temperature of the surface of the sea was 78°; at the depth of 25 fathoms, 76½°; at 50 fathoms, 71°; and at 125 fathoms, 62°; so that there was here a *progressive difference* of temperature of 2½° at 25 fathoms, 7° at 50 fathoms, and 16° at 125 fathoms.* Many more examples might be given to the same effect, if it were necessary. A very remarkable one is mentioned by Mr. Abel Clarke, in his late work: he informs us, that, "Captain Wauchope, of his Majesty's ship *Eurydice*, when within a few leagues of the Equator, during a calm, put his apparatus overboard, and allowed it to descend till it had run about 1,400 fathoms of line; but he estimated the perpendicular depth at 1,000 fathoms. The temperature of the surface was 73° of Fahrenheit. On drawing up the instrument, he found the thermometer marking 42°; a difference of temperature of 31°." And there can be little doubt, but that the difference of temperature was progressive, from the surface down to that depth.

It has already been observed, that, "in shallow seas, the cold substratum of liquid is brought nearer to the surface;" but though, as a general axiom, this may be true, yet it may not be relied on in particular cases. Some instances, in proof, may be collected from the journal of Captain Basil Hall, of the *Lyra*, from the Yellow Sea, 1816, who made some experiments on the temperature of the sea at the surface, at the Loochoo Islands, and in the Yellow Sea, &c.

On the 19th of July, when off Chusan,† in 32 fathoms of water, the temperature of the surface of the sea was 78° and 80°; and on the 22nd, in 43 fathoms, it was only 77° and 72°; but when at anchor in 3½ fathoms, in the Gulf of Pechelee, in lat. 38° 42′, and lon. 117° 49′ E., on the 27th of July, the temperature of the surface was as high as 82°. Also, on the 3rd of August, when at anchor off Pei-ho, the temperature of the surface was 82° at noon, and 80° at midnight, and *there* it was generally warmer than

* Admiral Krusenstern has given the temperature in the degrees of the scale of Reaumur: but we have reduced them to those of Fahrenheit, for the convenience of comparison, &c.—Ed.

† In latitude 30° 30′ North; longitude about 124½° East.

the atmosphere itself. When at anchor in Napakiang Harbour, the general temperature of the surface of the sea was about 83°, but out at sea, off the Island Loochoo, when in lat. 26° 36′, lon. 127° 56′ E., the surface was 4° or 5° *colder*; being on the 14th and 15th, only 79½° and 78°. Again, on the 20th of October, at anchor in Napakiang, when the autumnal cold had lowered the temperature of the sea's surface *there* to 75½° and 75° (or 7° and 8° below what it was when anchored there before), yet in the Sea of Japan the surface was also lower, being 74° and 73°.

Thus, in these particular instances, the water became *warmer* (at least at the *surface*, the *nearer* the land was approached, and also as the depth of water *decreased*.

It will presently be seen, from the Journal of Captain Livingston, that *under similar local circumstances* the water of the Gulf of Mexico, like that of the Yellow Sea, increases in heat toward its principal river; the one toward Mississippi, the other toward the Pei-ho. In the Mexican Gulf the heat of the sea was the greatest known, being at the temperature of 90° on the 30th of August, 1818, while that of the Yellow Sea was 82° on the 27th of July, 1816. The general principle as to the Atlantic Ocean is, however, incontrovertible.

Mr. Clarke has, also, published the result of a few experiments made by him on the temperature of the sea, in soundings both at the surface and bottom, which are highly useful and satisfactory. *They are shown in the following Table:—*

No.	Date, July, 1816.	North Latitude.	East Longitude.	Depth in Fathoms.	Place.	Temperature. Air.	Surface.	Bottom.	Difference of Temperature. Of the Air and Surface.	Of the Surface and Bottom	Of the Air and Bottom.
1	23 . 8 a.m.	35° 10′	123° 40′	40	Open sea.	76°	74°	65°	2°	9°	11°
2	24 : noon	36 24	122 59	15	do.	75	71	67	4	4	8
3	25 : 8 a.m.	37 30	122 40	20	do.	72	67	62	5	5	1
4	8 p.m.	... ...	... ...	15	do.	74	69	66	5	3	8
5	26 : 6 a.m.	37 58	121 34	15	The Meetan Islands.	74	67	66	7	1	8
6	27 : 11p.m.	38 12	120 30	15	Gulf of Pechelee.	75	74	72	1	2	3

From these experiments (Mr. Clarke observes) it appears, first, that the sea "diminishes in its temperature in proportion to its depth;" and second, "that the difference of the temperature of the surface and any given depth, within a certain range, is *greater* at sea than near the land;" and third, "that the difference of the temperature at the surface and bottom is *greatest*, when that of the air and surface is least."

The first and third positions appear evident on the face of the *experiments*; but the experiment No. 3 seems to affect the correctness of the second position, for the difference of the surface and 20 fathoms' depth was 5°; and by that of the first experiment, made *farther* from the land, there was a difference of 9° *only* in 40 fathoms, which was proportionally less than *near* the land.

It is remarkable, however, that all these experiments (except the third) prove, as far as they go, that in the depth of 15 fathoms the water in the bottom was invariably *warmer* than it was found to be at the depth of 40 fathoms in the open sea; and in the Gulf of Pechelee, where the sixth experiment was made, it was no less than 7° *warmer* at the depth of 15 *fathoms*.

The lower state of the atmosphere when the third experiment was made, would seem to account for the temperature of the water at the bottom being so much below what it was found to be by the others.

There is also a much larger proportional difference of the temperature of the air and water at the depth of 20 fathoms, than there was by the rest of the experiments.

These experiments also prove, that "in these shallow seas, however, the cold sub-

stratum of liquid *was not* brought *nearer* the surface" at this season of the year. So that in these instances there was no "increasing coldness of water drawn up from the depth of only a few fathoms, to indicate to the navigator, who traverses the wide ocean, his approach to land or banks, but the very reverse."—*Naval Chronicle*, October, 1818.

The Baron Humboldt has given the following statement, from numerous experiments which he made between the 9th of June and the 15th of July, 1799, on the *surface* of the Atlantic:—

Latitude.	Longitude from Greenwich.	Temp. of Water.
39° 10′ N.	13° 58′ W.	59°
34 30 —	14 35 —	61
32 16 —	14 44 —	63
30 36 —	14 34 —	65
29 18 —	14 20 —	66½
26 51 —	16 53 —	68
20 8 —	26 31 —	70
17 57 —	30 54 —	72
14 57 —	42 20 —	74
13 51 —	47 23 —	76½
10 46 —	58 34 —	78

From Corunna to the mouth of the Tagus, the water of the sea varied but little in its temperature; but from the 39th degree of latitude to the 10th the increment was very sensible and very constant, though not always uniform. From the parallel of Cape Mondego to that of the Salvages, the progress of the thermometer was almost as rapid as from 20° 8′ N. to 10° 46′; but it slackened extremely on the limits of the torrid zone, from 29° 18′ to 20° 8′. This inequality is, no doubt, caused by the currents which set on one side of the ocean to the S.E., and on the other to the N.W. Don Cosmo de Churruca, who crossed the Equator in October, 1788, in the 23rd degree of western longitude, found the greatest temperature of the water to be in the latitude of 6° N.* In these parts, in latitudes equally distant from the Equator, the water of the sea was colder to the South than the North.

From the Equator to the 25th and 28th degrees of North latitude, the temperature is remarkably constant, notwithstanding the difference of meridians. It is more variable in the high latitudes, where the melting of the polar ice, and currents caused thereby, diminish the heat of the ocean. The following table, which contains experiments taken without discrimination from several nautical journals, confirms these assertions.

TABLE OF THE TEMPERATURE OF THE ATLANTIC OCEAN.

Latitude.	Longitude.	Temperature.	Time.	Observers.	Mean Temperature.
0°58′ S.	25°14′ W.	81°	Nov. 1788	Churruca.	80½° (Cook.)
0 57 —	27 51 —	82	April......1803	Quevedo.	
0 33 —	19 0 —	82	March ...1800	Perrins.	
0 11 N.	81 55 —	82½	Feb. 1803	Humboldt.	
0 13 —	49 22 —	81	May 1800	Perrins.	
25 15 —	18 16 —	68	June......1799	Humboldt.	69¾° (La Pérouse and Dalrymple.)
25 29 —	37 34 —	70	April......1803	Quevedo.	
25 49 —	24 0 —	69	March ...1800	Perrins.	
27 40 —	14 44 —	70	Jan. 1768	Chappe.	
28 47 —	15 57 —	78	Oct. 1788	Churruca.	
42 34 —	13 25 —	52	Feb. 1800	Perrins.	54° (Cook and D'Entrecasteaux.)
43 17 —	29 7 —	60	May 1813	Quevedo.	
43 58 —	10 47 —	60½	June......1799	Humboldt.	
44 58 —	32 27 —	54	Dec. 1789	Williams.	
45 13 —	2 20 —	60	Nov. 1776	Franklin.	
48 11 —	11 58 —	57½	June......1791	Williams.	

* This, it may be observed, accords with the termination of the S.E. trade-winds to the northward of the Equator (see Table, page 119); and there is no doubt that it is equally variable. Little argument is required to prove that the two fluids, air and water, and their modifications, winds and currents, are affected by similar impulses. A certain parallel to the North of the line may be considered as the equator of temperature between the ices of the northern and southern polar regions.—ED.

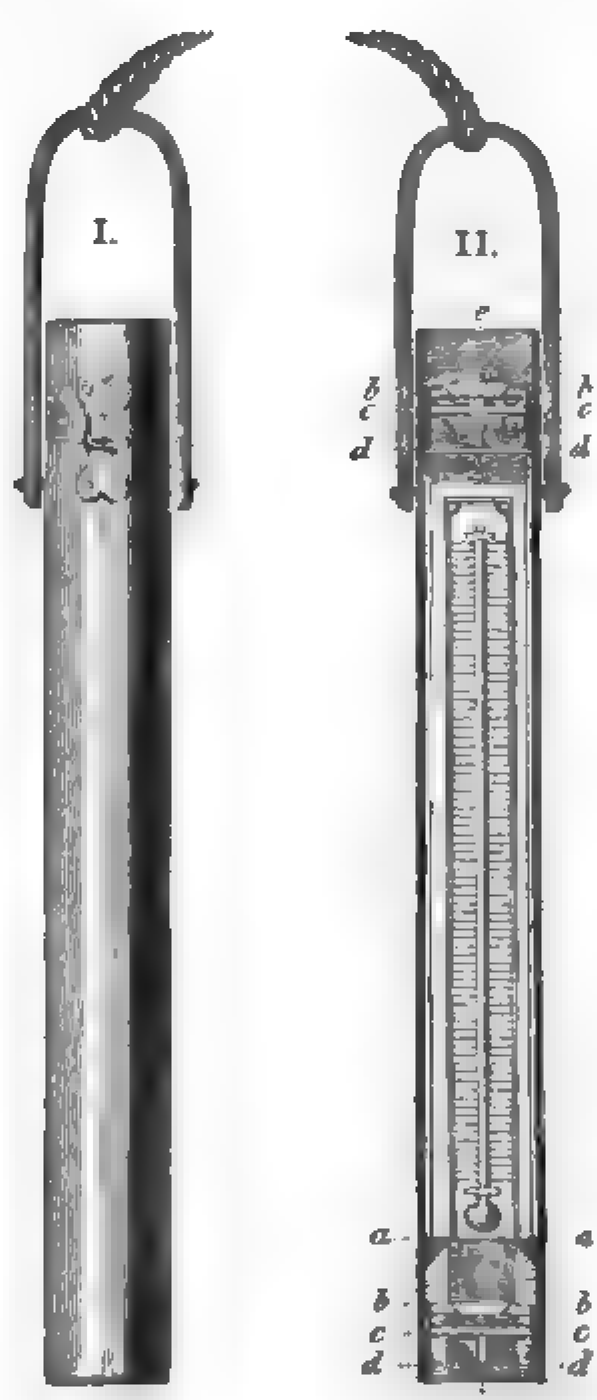
In 37° N., and 10¾° W. (off Cape St. Vincent), on the 2nd of May, 1833, the temperatures at the depths specified, while that of the air and surface water was 63°, were, at 1 fathom, 62°; at 5 fathoms, 61°; at 20 fathoms, 60°; at 100 fathoms, 58°; at 250 fathoms, still 58°; the current running S. 38° E., 16 miles in the twenty-four hours.

Baron Humboldt adds:—" It is very remarkable, that, notwithstanding the immensity of the ocean, and the rapidity of the currents, there is a great uniformity everywhere in the greatest heat of the equinoctial seas. Don Cosmo de Churruca found it, in the Atlantic Ocean, at 83°; Mr. Perrins, in 1804, at nearly the same; Mr. Rodman, in a voyage from Philadelphia to Batavia, $83\frac{3}{4}$°; and M. Quevedo, $83\frac{1}{3}$°. We must recollect, that, under the temperate zone, to the North of the parallel of 45°, the mean temperature of different years varies more than 4°.

" The greatest heat of the sea, which is from 82 to 84 degrees, proves, more than any other consideration, that the ocean is, in general, warmer than the atmosphere with which it is in immediate contact; and of which the mean temperature, near the Equator, is from 68° to $80\frac{1}{3}$°."—*See, further, Humboldt's Personal Narrative*, Engl. Tr., vol. ii. p. 68.

IMPROVED MARINE THERMOMETER.

Captain Livingston says:—" In my thermometric experiments I had several thermometers broken, and I have heard objections made to the experiments, that, in the manner they were made, the thermometer was not immersed far enough to enter into water sufficiently uninfluenced by the heat of the solar rays; but it will be seen, by comparing the day and night observations, that this is a futile objection. However, to avoid it, to secure my thermometers from being broken, and to enable me to have a column of water round the thermometer, sufficient to retain its original temperature till such time as the degree indicated by the thermometer scale could be read off, keeping at the same time the bulb of the thermometer immersed in the water, I prevailed on an ingenious mechanic to attempt the structure of such a case as I wanted, in which he has most happily succeeded."



The person here alluded to is Mr. Robert Jamieson, a partner of the firm of Gardners, Jamieson, and Co., Mathematical Instrument Makers, in Glasgow, who has been honoured with the large silver medal of the Society for the Encouragement of Arts, as a public testimony of the value and utility of the invention.

Description.—The first figure, hereto annexed, represents the case, a tube of copper, which encloses a thermometer: the second figure represents a thermometer, so enclosed. The length of the whole tube, including the lid, is about 18 inches, and its external diameter 2 inches. The lid, which has a check to fit the tube, is about 2 inches deep, and has a conical or puppet valve in it, which rises upward. At the lower end of the tube is another valve of the same description, which, also, rises upward; and these two valves permit the water to pass freely through the tube while it descends in the water; but so soon as it stops, the valves shut, and the water admitted, at the greatest depth to which the machine is sunk, remains in the tube, around the thermometer.

Fig. I. is a back view of the case ready for use. In Fig. II., *a a* represents a ring, or collar, on which the thermometer-plate rests, to keep it clear of the lower valve: *b b*, the

upper valve and valve-tube cover: *c c* a bridge on which the neck, rod, or journal, of the valve works, through a hole in a swell in the centre of the bridge: *d d*, lower part of the journal, with a screw-head, which keeps it from rising through the hole in the bridge: *e e*, ends of the journals.

Mr. JAMIESON'S DIRECTIONS for the Use of the MACHINE are as follow:—

In using the MARINE THERMOMETER CASE, a stout line, of some fathoms in length, must be made fast to the handle of the case, which may be carried forward, and hove like the deep-sea lead. The length it must be passed forward will depend on the velocity with which the vessel, on board of which it is used, moves through the water; but a few experiments will show the intelligent observer what length of time is necessary to allow the mercury to rise or fall sufficiently, to indicate the true temperature of the sea. The observer must then haul up the case by the line, open the lid, and draw out the thermometer a sufficient length to allow of the altitude, as pointed out by the mercury in the thermometer-tube being read off; but, in doing this, care should be taken always to keep the bulb of the thermometer immersed in the water contained in the case.

In practice, the case ought to be sunk as perpendicularly as possible, in order to ensure the free passage of the water through it; and care must be taken never to permit it to touch the bottom, as sand, or other substances, might get in, and render the lower valve of no use till cleaned again.

The depth to which the instrument should be sunk, must depend on various circumstances, but it is apprehended a few fathoms will generally be found sufficient. Probably it may be deep enough to sink the thermometer a foot or two lower than the ship's keel; but attentive observers will hardly fail to try it both at greater and lesser depths.

The frequent use of the thermometer is earnestly recommended; and it may be interesting at the time when the observations are made on the heat of the sea, to note corresponding ones on the temperature of the air, though this is not essentially necessary.

Thermometric observations of the temperature of both the air and water may be taken every two hours; and, for convenience, two additional columns marked upon the log-slate; the one of which, denoting the temperature of the air, entitled T. A., at the top of the column, while T .W., at the head of the other, will denote the temperature of the water. From the log-slate, these observations may be copied into a private journal, if not inserted in the ship's log-book.

We are happy to find that this instrument is generally approved; and, as its great utility is obvious, expect that it will be shortly in general use.

OF THE MARINE BAROMETER AND SIMPIESOMETER.

THE MARINE BAROMETER is an instrument too well known to require description. On page 169 we have noticed the effect of the barometer, and its amount on the tides; and on page 136 will be found the general principle of the barometer, and of the causes which operate on it; and again, on page 137, the effects of a storm or hurricane on the barometer are described.

In the description of hurricanes alluded to in the pages quoted, we have mentioned the *Aneroid Barometer*, a mechanical contrivance for effecting the purpose of the mercurial column, and the defects to which it is liable. The reader is requested to refer to the pages quoted for this subject.

Captain Horsburgh says:—"This is a very useful instrument in *high latitudes*, by assisting navigators to anticipate approaching storms. Previous to a hard gale of wind, there is generally a great fall of the mercury, and even *near the tropics*, the fall of it, before a storm or hurricane, is usually considerable. Within 9° or 10° of the Equator, there seldom, or never, is a hurricane or storm of *long* duration; but whirlwinds and hard squalls, of a *few* hours' continuance, are sometimes experienced within these parallels of latitude without any fall of the mercury. Indeed, the barometer is of little use as a guide in prognosticating storms which may happen within the tropics, except before a severe hurricane, when there is often a considerable fall of the mercury, the latitude being not less than 14° or 15° North or South.

"It is proper to observe, that in the open ocean, between the tropics, in settled weather,

there is a *flux* and *reflux* in the atmosphere twice every twenty-four hours, resembling the tides in the sea; but these atmospherical tides depend upon the sun's influence and the rotation of the earth, and do not follow the motion of the moon. The rise and fall of the mercury, in consequence of these tides, is about 6 or 7 of the hundredth parts of an inch, in settled weather near the Equator; the high station happening about eleven o'clock in the morning and eleven o'clock at night, and the low station about five o'clock in the morning and evening. The regularity of this flux and reflux of the atmosphere is *obstructed by land*, but, in the ocean, it prevails to lat. 26° North and South; and, in fine steady weather, it may be perceived as far as lat. 30° or 32° North and South. In high latitudes, the motion of the mercury, in the barometer, like the winds, is mutable and uncertain; but, previous to a storm, or gale of wind, there is commonly a great fall, and the mercury begins to rise before the conclusion of the gale; sometimes even at its commencement, as the equilibrium in the atmosphere begins to be restored.

"Although the mercury sinks lowest before high winds, it frequently sinks considerably before a heavy fall of rain; and when the mercury stands low, the air is light, and deprived of expansibility or elasticity, therefore not capable of supporting much gaseous moisture; at such periods, consequently, rain generally falls. The mercury, also, sinks on the approach of thunder and lightning, or when the atmosphere is highly charged with electric matter.

"In serene, settled weather, the mercury commonly stands high, also in clear, frosty weather. The mercury, in the open sea, is, in general, inclined to rise with easterly, and fall with westerly, winds. It is likewise necessary to remember, that in the northern hemisphere, in the open sea, the mercury rises with northerly, and falls with southerly, winds; because the former, coming from the frozen parts, near the Pole, are more dense than the latter, which flow from the equatorial regions. In the southern hemisphere, the contrary takes place; for there the mercury rises with the cold southerly winds, and falls with northerly winds. These effects are more particularly observed in high latitudes, on the ocean; for obstructions and irregularities will always happen near land; because there the rarefaction and expansibility of the atmosphere are not so equal as over the ocean.

"After very warm and calm weather, in winter particularly, a storm is likely to follow; or at any time that the atmosphere is *greatly heated* above the medium temperature.

"By proper attention to the marine barometer, the experienced navigator may often be enabled to anticipate the changes of weather; and in some seas, he may, by its indications, even take in or let out reefs in the night. It is also advisable to observe the phases and progress of the moon; for it is reasonable to suppose that the influence of that planet upon the atmosphere must be considerable in penetrating through it to the surface of the ocean."

In brief, a change of weather seldom fails to be indicated by the least rising or falling of the mercury in the barometrical tube: the descent, in tropical latitudes, of an eighth of an inch, when at a distance from the land, is the unequivocal indication of an approaching storm. Many a ship has been saved from destruction by the timely notice given by this instrument to prepare for a storm, and *no ship should be permitted to go to sea without one.*

Dr. Arnott, in his excellent book, entitled, *Elements of Natural Philosophy*, has said:—"To the husbandman, the barometer is of considerable use, by aiding and correcting his prognostication of the weather, drawn from local signs familiar to him; but its great use as a weather glass seems to be to the mariner, who roams over the whole ocean, under skies and climates altogether new to him. The watchful captain of the present day, trusting to this extraordinary monitor, is often enabled to take in sail and to make ready for the storm, where, in former times, the dreadful visitation would have fallen upon him unprepared. The marine barometer has not yet been in general use for many years, and the author was one of a numerous crew, who, probably, owed their preservation to its almost miraculous warning. It was in a southern latitude. The sun had just set with placid appearance, after a beautiful afternoon, and the usual mirth of the evening watch was proceeding, when the captain's order came to prepare with all haste for a storm. The barometer had begun to fall with appalling rapidity. As yet the old sailors had not perceived even a threatening in the sky, and they were surprised at the extent and hurry of the preparations; but the required measures were not completed, when a more awful hurricane burst upon them than the most experienced had ever braved. Nothing

could withstand it; the sails, already furled and closely bound to the yards, were riven away in tatters; even the bare yards and masts were in great part disabled; and, at one time, the whole rigging had nearly fallen by the board. Such, for a few hours, was the mingled roar of the hurricane above, of the waves around, and of the incessant peals of thunder, that no human voice could be heard, and, amidst the general consternation, even the trumpet sounded in vain. In that awful night, but for the little tube of mercury which had given the warning, neither the extraordinary strength of the noble ship, nor the skill and energies of the commander, would have saved one man to tell the tale. On the following morning the wind was again at rest, but the ship lay upon the yet heaving waves an unsightly wreck."

Within the tropics, the fact of the barometer not being affected by any change in the atmosphere, except when under the influence of an approaching storm, is the very circumstance which more particularly enhances its value. In high latitudes the eye of an experienced seaman will prove a tolerably correct substitute for a barometer; but the tropical hurricane, unlike the storms of higher latitudes, frequently gives no other warning of its approach than that which the barometer affords. The practical inference from these premises is, that, whenever within the tropics an unusual fall of the barometrical column is observed to take place, it may be taken for granted that an extraordinary degree of the atmospheric rarefaction is in progress, which will be speedily followed by a violent reaction; and from that moment the ship may be said to have perforated the confines of a circle, the centre of which will shortly become the focus of a tornado.—(*Captain J. Marshall.*)

In the month of October, 1808, a remarkable and very destructive hurricane occurred in the Indian Ocean, as described in the *Athenæum*, No. 632, December 7, 1839, and which is also noticed in Colonel Reid's volume, pp. 218—221.* Introductory to his description, Captain Marshall, of the *Diana*, in the Company's service, urges commanders to pay the most pointed attention to the indications of the marine barometer, which, he says, never fails, by the fall of the mercury, to indicate an approaching storm. The seaman is thus enabled, by bringing his ship to the wind, and other preparations, to secure to himself the best chance of escaping damage. "Even if, at the moment, the sky should be cloudless, the atmosphere motionless, and no other indication of a storm throughout the whole visible horizon, than that which this invaluable instrument affords him, still he will take his measures with the same degree of promptitude and energy as though the danger had already commenced; and when the flattering gale springs up to favour his course, he will not be tempted to pursue it through any fallacious notion of shortening the period of his voyage, for he may rest assured that the farther he advances the greater will be the fury of the tempest, and his easiest way to escape from its effects is to remain as stationary as possible. I should not have dwelt on some of these points had I not been aware that a notion is but too prevalent among seamen, that scudding before the storm is the shortest way to get out of it; an error which is attended with this additional evil, that those precious moments which intervene between the fall of the quicksilver and the rising of the storm are expended (perhaps never to be retrieved) in a proceeding which, in my opinion, is fraught with nothing but mischief."

We have given, on page 156, a comparative scale, formed by Captain Richard Leighton, of the elevation of the barometer, and the distance of the centre of a hurricane or cyclone. This, if it can be carried out to an efficient degree, is a most important addition to the uses of the marine barometer.

CANARY ISLANDS.—"In no part of the world is the barometer more susceptible of atmospheric changes than amongst the Canary Islands. A rapid rise is the sure precursor of an easterly wind, whilst the contrary as certainly indicates a change to West or S.W. The easterly wind is accompanied by foggy or hazy weather; but clear immediately on changing in the least to the northward. When it blows strong from this quarter it is

* The storm was first met by the *Diana* in 8° S. and 88° E. Captain Marshall says, "It is impossible to convey to the minds of those who have never witnessed such a storm any adequate idea of the fury with which it blew, during the three days and nights of its continuance, the sound resembling more a succession of peals of thunder, or the roaring of cannon, than of wind; whilst the sea formed one continued breach over the ship, sweeping everything moveable before it."

Of the nine ships under convoy of the *Albion*, 74, from Madras, October 5, the *Glory*, *Lord Nelson*, and *Experiment*, foundered.—See Colonel Reid on the "Law of Storms," pp. 218—221.

called, by the fishermen, a *brisa parda*. The temperature of the air is very equal: the average, in December, was 67°; in January, 67°; in February, 65°; May, 69°; August, 76°; and it seldom varied more than 4° or 5° in the twenty-four hours."—(*Lieutenant Arlett.*)

BAROMETER at the BAHAMA ISLANDS.—The following remarks on the barometer, from observations made at NEW PROVIDENCE, during the years 1837 and 1838, are from those of the *Hon. J. C. Lees*, chief justice of Nassau :—

The words "*fair*, *change*, *rain*," &c., marked on the plate of the instrument, are here of no use whatever; on the contrary, they tend to mislead.

The range of the mercury in the barometer, except in storms, is greater in the winter than in the summer months: in the West Indies it neither rises nor falls to anything like the extent to which it does in Europe, but the fluctuations, though small, are equally to be depended on.

Rain in this climate has but little effect on the barometer, which appears to be operated upon principally by the wind, rising or falling according to the direction from whence it blows. Thus the barometer will be much higher with winds from North to East, accompanied by rain, than when they blow from South to N.W., without rain.

The barometer rises highest when the wind is N.E., and falls lowest when it is N.W.

If during the winter months, or beginning of November to the end of March, the wind is steady at N.E., the barometer will stand at about 30 to 30·1 and 30·2; if then the weather becomes squally, and the mercury *rises* much (say one-tenth of an inch more), it indicates, as far as I can judge from three instances, a gale or very stiff breeze from the same quarter; this is remarkable, for in all other cases of gales the mercury falls. If with the wind at N.E. the mercury falls, the wind will become more easterly; if it continues to fall, it will go round to the S.E., South, and so on to the N.W., which will be its lowest point; in ordinary north-westers, about 29·9; but if, instead of sinking thus gradually, it falls much, and suddenly, with the wind at N.E., or at any intermediate point from that to South, the probability is that there will be a sudden lull, and the wind will fly round at once to the N.W.

If, however, after the mercury has been gradually falling, and at any of these intermediate points it rises again, the wind will, in that case, back to the East or N.E., and will continue there until the mercury has again fallen.

When the wind is at N.W., if the mercury continues low, the probability is that it will continue for some time at that point; but, if it rises, it is a certain indication that the wind will go to the northward, and continue to rise to the N.E.; but, if it falls with the wind at North, it will back again to the N.W.; if the rise with the wind at N.W. is much and rapid, the wind will not remain at North, but will go at once to the N.E.

During the summer months the winds vary from N.E. to South, the prevailing ones being between East and South; the barometer will, therefore, be found to fluctuate between one-tenth of an inch above, to one-tenth below, 30 inches; being highest, as before stated, on the approach and during the continuance of N.E. winds; and lowest, during or previous to southerly ones; but there is, frequently, a very light South wind in the mornings and evenings, extending but a small distance from the shore, which I take to be of the nature of the land-wind of the larger islands, and this wind does not seem to affect the barometer.

When, during the hurricane months, the barometer falls much and rapidly, preparations ought to be made for rough weather. Suppose, for instance, from standing at 30·2 it were to fall rapidly to 29·8, this ought to awaken suspicion; but, if it were to fall one or two-tenths more, there would be almost a certainty that a heavy gale would in a very short period follow: this fall of the barometer might be only an hour or half an hour before the hurricane; but a great deal might be done, for the security of vessels or houses, in that time.

These observations are the result of only about two years' experience, a period too short to afford data for any certain conclusion on such subjects; it is very possible that circumstances may expand or condense the atmosphere, so as to occasion a rise or fall of the barometer, independently of the changes of the wind or the approach of a gale; or, on the other hand, that a gale might occur without a previous warning from the instrument. I can only, therefore, advise those who have a barometer, on the one hand, never to despise its indications of a storm, because the weather appears fine; on the other, never

to neglect the precautions which an appearance of adverse weather would suggest, merely because the barometer had not fallen; it would be better to make unnecessary preparations ever so many times than to lose valuable property once from the want of them.—*Nautical Magazine, Feb.* 1839. Nassau, 12th July, 1838.

GULF and RIVER of ST. LAWRENCE.—*Captain Bayfield*, in his general remarks on the navigation of the *Gulf and River of St. Laurence*, states that the barometer has here a range of from 29 to 30·5 inches during the navigable season, and its changes accompany those of the winds and weather with a considerable degree of constancy. The fluctuations of the barometric column are much greater and more frequent there than in lower latitudes; and sudden alterations, which in other climates would be alarming, may occur there without being followed by any corresponding change, either in the wind or weather. But the navigator should not be inattentive to those minor changes, as a constant attention to the instrument can alone enable him to appreciate those decisive indications of the mercury which seldom or never prove deceptive.

The following remarks will apply to those well-marked changes which usually indicate the approach of a gale of considerable strength, or of a shift of wind and weather, the correct anticipation of which is often of the utmost consequence to the safety of a vessel, as well as to the length of her voyage:—"When, after a continuance of westerly winds and fine weather, the barometer has risen nearly to its greatest height, say some tenths above 30 inches, or begins to fall a little, an easterly wind may be soon expected. If to this notice given by the barometer be added a warm hazy atmosphere during the day, and a heavy precipitation of dew at night, with very bright twinkling stars, or a coloured *Aurora Borealis*, the approach of an East wind is almost certain. If land be in sight at such a time, and appears much distorted by terrestrial refraction, or if vessels in sight have any relative proportions of their hull and sails changed by the *mirage*, or present double or treble images, such appearances will render the before probable indications of the barometer certain. At the commencement, the easterly wind will probably be light, with fine clear weather, but this will not last above a few hours, if the barometer continues to fall; on the contrary, the wind will gradually increase, and, as it does so, the sky will become overcast, by degrees, until it is completely clouded. Rain and fog will follow, and continue during the continuance of the easterly wind, with little intermission, until they are dissipated by a fresh breeze from the contrary quarter.

"If the fall of the barometer, during the continuance of the easterly wind, be very slow, the gale will probably continue, and not be very violent; if rapid, it will probably be of short duration, and of greater strength; at any rate, when the mercury falls toward 29 inches, a change is certainly at hand, and the gale will, in general, come from the N.W. The strength of this succeeding gale will be in proportion to the fall of the barometer, and to the strength of the easterly gale which preceded it. In such a case, there is seldom many hours' interval between the one gale and the other. The East wind generally dies away to calm, and in a very few hours, or sometimes in much less time, the N.W. gale springs up. A heavy cross sea remains for some time from the previous gale.

"The barometer sometimes begins to rise in the interval of calm which precedes the N.W. gale; at others, at its commencement: the fogs and rain cease, and the weather becomes quite clear, generally in a few hours, and sometimes almost immediately. The strength of the westerly gale is usually greatest soon after its commencement, and diminishes as the barometer rises, veering gradually to the West and S.W.

"It is worthy of remark, that these circumstances just mentioned are exactly the reverse of those attending the easterly gale. The latter usually commences with clear weather and a high barometer, light at first from the South or S.E., and gradually increasing as it veers to the eastward, with a falling barometer.

"To return to the westerly gale:—If, after it has veered to S.W. and become moderate, the barometer remains steady at a moderate height, fine weather may be expected. If it remains at a considerable height, but still fluctuating and unsteady, within certain limits, variable, but not heavy, winds, and variable weather may be expected. If, on the contrary, it rises quickly to a great height, a repetition of the easterly gale will not be improbable. We have experienced seasons, in which the barometer may be said to have been no sooner blown up by one wind than it has been blown down by another, and this stormy alternation to have continued for several months; whilst, in others, we have had scarcely a double-reefed topsail breeze during the whole summer.

"There is, in fact, so great a difference in the phenomena of the weather in different

seasons, that it becomes very difficult to write anything respecting it that shall not be liable to many exceptions. There are, however, some strongly marked cases of connexion between the indications of the barometer and changes of the winds and weather, which, within our experience of eight or nine years, have been subject to few, I might almost say no, exceptions. The first of these cases is that most common one, which I have endeavoured to describe, of an easterly gale, with a falling barometer, being always wet and foggy, and succeeded by a strong wind from the opposite quarter with a rising barometer. A second case, not of so frequent occurrence in common seasons (excepting in spring or early in summer), is the easterly wind with a rising barometer; which, although it may not be at first for a few hours, will almost always become fine and clear, and end in fine weather. A third case may be considered certain:—If the barometer fall suddenly and greatly, at any time, a northerly, and most probably a N.W. gale, of great strength, may be confidently expected. It does not follow that will be immediate, for it may be preceded by a strong gale from S.W. for a few hours, during which the barometer will seldom rise, and even, probably, continue to fall; but when the S.W. gale dies away, the northerly or N.W. will soon succeed, with a rising barometer.

"In conclusion, I may remark, that, as, on the one hand, a considerable fall of the barometer may occur, without being followed by a strong wind, so, on the other, a breeze of considerable strength may come on, without any indication from the barometer; but not anything that deserves the name of a gale. There has never, within our experience, occurred a gale so heavy as to be of serious consequence to a good vessel, the approach of which has not been indicated by the barometer. But it must be remembered, that a high barometer, in this climate, and under the circumstances which I have mentioned, is often indicative of an easterly gale.

"It is remarkable that, in the Gulf and Estuary of St. Lawrence, a high barometer may be considered as the forerunner of wet and foggy weather, which usually accompanies its fall; whilst a low barometer renders it equally probable that dry weather will ensue, since it often accompanies its rise. I am fully of opinion that the marine barometer is of the greatest assistance in the navigation of the Gulf and River of St. Lawrence, and that, by attending constantly to its state and changes, with reference to the winds and weather which preceded them, combined with the indications afforded by the appearance of the sky, &c., those changes of the wind and weather, which are about to take place, may be anticipated with a degree of certainty sufficient, in most cases, to enable us to avoid being caught on a lee-shore, or in an unsafe anchorage, as well as to regulate our course in a voyage, in anticipation of the coming change."

The SIMPIESOMETER is an improved air-barometer, invented by Mr. Alexander Adie, F.R.S., Edinburgh, who has given a description and figure of it in the *Edinburgh Philosophical Journal*, vol. i., page 54. One of the first which was made was sent from the Clyde, in the ship *Buckinghamshire*, on her voyage to the East Indies, 1816; and the following is the report given of the instrument, by the late Captain Christian, the commander, on his return:—

"I am glad to say, that I consider your barometer a valuable instrument at sea, having given it a fair trial on the outward passage to India, by keeping a correct register of it, as well as of the common marine barometer, taken every third hour, night and day, during the passage; and I not only found, that it was fully as sensible of the changes of the atmosphere as the other barometer, but that it had a great advantage over all barometers I have ever seen used at sea—namely, that of not being, in the smallest degree, affected by the motion of the ship, which will often make the quicksilver in the common tube plunge, or rise and fall, in such a degree, as to make it very difficult to come within, at least, one or two-tenths of an inch of the truth, even in the largest ships. On the passage home, I also found it very correct in the indication of the winds and weather."

Lieutenant William Robertson, who was on the Northern Expedition of 1818, has said of it, "The simpiesometer is a most excellent instrument, and shows the weather far better than the marine barometer. In short, the barometer is of no use compared to it. If it has any fault, it is that of being too sensible of small changes, which may frighten a reef in, when there is no occasion for it; but, taking it altogether, in my opinion, it surpasses the mercurial barometer, as much as the barometer is superior to having none at all."

The simpiesometer has also been tried on board the yacht of the Commissioners of

Northern Lighthouses; and Mr. Stevenson, the engineer, has given his attestation of its superiority. Mr. Stevenson says, that having occasion, toward the conclusion of his voyage, in September, 1819, to visit the Isle of Man, he beheld the interesting spectacle of about 300 large fishing-boats, each from 15 to 20 tons burden, leaving their various barbours at that island, in an apparently fine afternoon, and standing directly out to sea, with the intention of prosecuting the fishery under night. He, at the same time, remarked, that both the common marine barometer and Adie's simpiesometer, which were in the cabin of the vessel, indicated an approaching change of weather, the mercury falling to 29·5 inches. It became painful, therefore, to witness the scene; more than 1,000 industrious fishermen, lulled to security by the fineness of the day, scattering their little barks over the face of the ocean, and thus rushing forward to imminent danger, or probable destruction. At sunset, accordingly, the sky became cloudy and threatening; and, in the course of the night, it blew a very hard gale, which afterward continued for three days successively. This gale completely dispersed the fleet of boats, and it was not without the utmost difficulty that many of them reached the various creeks of the island. It is believed no lives were lost on this occasion; but the boats were damaged, much tackle was destroyed, and the men were unnecessarily exposed to danger and fatigue. During the same storm, it may be remarked, thirteen vessels were either lost or stranded between the Isle of Anglesea and St. Bees Head, in Cumberland. Mr. Stevenson remarks, how much it is to be regretted, that the barometer is so little in use in the mercantile marine of Great Britain, compared with the trading vessels of Holland; and observes, that, though the common marine barometer is perhaps too cumbersome for the ordinary run of fishing and coasting vessels, yet Adie's simpiesometer is so extremely portable, that it might be carried even in a Manx boat. Each division of such vessels has a commodore, under whose orders the fleet sails; it would, therefore, be a most desirable thing, that a simpiesometer should be attached to each commodore's boat, from which a preconcerted signal of an expected gale, or change of weather, as indicated by the simpiesometer, could easily be given.

VIII.—THE THERMOMETER, WITH SCALE OF TEMPERATURES.

Of the instruments for measuring the increase and decrease of heat and cold, there are several sorts, but particularly those denominated the *Thermometers of Fahrenheit*, of *Reaumur*, and of the modern *French*. The first, which is deservedly preferred, and generally used in England, is that of M. *G. D. Fahrenheit*, who was born at Hamburgh, in 1686, and died in 1736; the second is that of M. *Reaumur*, an eminent French naturalist, and member of the Academy of Sciences, who died in 1757; the last is that of the modern French mathematicians.

The scale of Fahrenheit is that exhibited beneath. Reaumur's scale differs from it, in having the space between the boiling and freezing points of water divided into 80° only. On the latter, the new French scale is an improvement, it having the same space divided into 100°, and it is hence called the *Centigrade* or *Centesimal Scale*. There is also another French scale, that of Delisle, divided into 150°, thus approaching nearer to Fahrenheit, but not generally known.

At 600° of Fahrenheit, or the common scale, mercury boils.
546, oil of vitriol boils.
242, spirit of nitre boils.
213, cow's milk boils.
212, common fresh water boils; 80° on *Reaumur's Scale;* and 100° on the *French Centesimal Scale.*
190, brandy boils.
175, alcohol, or spirits of wine, boils.
156, serum of blood and white of eggs harden.
146, kills animals in a few minutes.
142, bees' wax melts.
112, spermaceti melts.
108 to 99, hens hatch eggs.
107 to 103, heat of the skin in ducks, geese, fowls, pigeons, partridges, &c.
106, heat of the skin in a common fever.
103 to 100, heat of the skin in cattle, sheep, dogs, cats, &c.

At 99 to 92, of Fahrenheit, or the common scale, heat of the human blood in health.
97, heat of a swarm of bees.
84, sea-water, eastward of Cape Palmas, Africa, in May.
82½, mean temperature of the air at the Equator.
82, common heat of the sea near the Equator.
80, heat of the air, in the shade, in very hot weather.
75 to 72, temperature in which the pineapple, cinnamon, rhubarb, &c., flourish.
74, butter begins to melt.
72 to 70, grapes, coffee, pimento, tamarinds, &c., flourish.
67 to 60, aloes, Indian fig (*cactus opuntia*), capers, &c., flourish.
64, heat of the air, in the shade, in warm weather.
60, mean temperature of the Bermudas in winter, or November to March.
55, mean temperature of the air in England.
50, mean temperature of the surface of the earth.
43, oil of olives begins to stiffen, or become opaque. Freezes at 36°.
40, *Dew point* of the hygrometer.
32, water just freezing, or snow and ice just melting. ZERO or 0 on *Reaumur's*, and on the *French Centesimal Scale*. Mean temperature at the North Cape.
30, milk freezes.
28, urine and common vinegar freeze.
20, wines, Burgundy, strong claret, and Madeira freeze.
0 (*Zero.*) A mixture of snow and salt, which is able to freeze oil of tartar, but not brandy.
39, below 0, mercury or quicksilver freezes.

As connected with this subject, the indications of a change of weather, we annex a description of SQUALLS, from the work of the distinguished navigator to whom we are indebted for the leading paragraphs of the present section.

"SQUALLS are generally of THREE kinds: that called the ARCHED SQUALL is frequently experienced, and usually rises from the horizon in the form of an arch; but, somtimes, it assumes the appearance of a dense dark cloud, particularly when highly charged with rain, or electric matter. From the time that the arch or cloud is first seen above the horizon, its motion is sometimes very quick to the zenith, the interval being scarcely sufficient to allow a ship to reduce the necessary sail before the wind reaches her, which happens when the cloud has approached to the zenith. At other times the motion of the cloud is very slow, and not unfrequently it disappears, or is dispersed, the impulse of the wind being not then sufficient to reach a ship. As a general rule, it may be observed, that, if there be rain in these squalls preceding the wind, the latter will probably follow the rain in sudden severe gusts; whereas, if the wind precedes the rain, the squalls are seldom so furious, and terminate in moderate showers of rain. This general rule, however, is often interrupted by the operation of local causes.

"The DESCENDING SQUALL is not so easily discerned as the former; because it issues from clouds which are formed in the lower parts of the atmosphere, near the observer; and when clouds are thus formed, they generally produce showers of rain, and successive squalls of wind.*

"The WHITE SQUALL is not often experienced; but it sometimes happens near to, or within, the tropics, particularly in the vicinity of mountainous land. This squall generally blows very violently for a short time; and, as it is liable to happen when the weather is clear, without any appearance in the atmosphere to indicate its approach, it is consequently very dangerous. The only mark that accompanies it is the white broken water on the surface of the sea, which is torn up by the force of the wind.

"SQUALLS, and also storms, are sometimes progressive, at other times regressive, when obstructed by an opposite wind; or, according as the point of greatest rarefaction is situated.

"When a squall is opposed by an opposite wind, its motion is *greatly retarded thereby*; and a ship sometimes, in this case, outruns the squall, and overtakes other ships which are within the limits of the opposite wind."

* In the Mexican Sea heavy and very sudden descending squalls come at times from very small clouds. These are scarcely felt until the cloud is almost right over the ship's masts.—*A. L.*

On the 12th of January, 1832, H.M.S. *Beagle*, after visiting Tenerife, was proceeding toward the Cape Verde Islands, in about 20½° N. and 21° W., when an unusual appearance was observed:—"A cloud," says Captain FitzRoy, "like a dense fog-bank approached; and, as it drew near, the lower and darker part became arched, and rose rapidly, while under it was a white glare, which looked very suspicious. Sail was immediately reduced —we expected a violent squall; but the cloud dispersed suddenly, and only a common fresh breeze came from the opposite quarter. Neither the simpiesometer nor the barometer had altered at all; but the cloud was so threatening that I put no trust in their indications, not being then so firm a believer in their prophetic movements as I am at present. Nevertheless, I would by no means advocate the neglect of any precaution suggested by appearances of the weather, although no change should be foretold by the glasses. A mistake may be made by the observer, or a variation in the height of the column may have passed unheeded; while it is seldom that a practised eye can be deceived by the visible signs of an approaching squall or gale of wind.

"Undoubtedly the worst wind, next to a hurricane, which a vessel can encounter, is a violent '*White Squall*,' so called because it is accompanied by no cloud or peculiar appearance in the sky, and because of its tearing up the surface of the sea, and sweeping it along so as to make a white sheet of foam. By squalls of this description, frequent in the West Indies, and occasionally felt in other parts of the world, no notice will be given much above the horizon; but, by consulting a good barometer or simpiesometer, and frequently watching the surface of the sea itself, even a white squall may be guarded against in sufficient time.

"Dark clouds, hard mixed with soft, and inky fragments in rapid motion beneath them, accompanied, perhaps, by lightning and distant thunder, are the forerunners of a heavy squall. Soft shapeless clouds, in which it is impossible to point out a definite edge, usually bring rain, but not wind; and, generally speaking, the more distinctly defined the edges of clouds are, the more wind they foretell. A little attention to these simple observations, so familiar to persons who have been some time at sea, may save young officers unnecessary anxiety in one case, and prompt them to shorten sail at a proper time in the other."—(*Voyage*, vol. ii. p. 49.)

For the SQUALLS about the BERMUDA ISLES, see page 471.

"Captain Reuben Bunker, an old and experienced seaman of Nantucket, has related that he has often, and sometimes for several days together, rode out a heavy gale at sea by furling all his sails, pointing his yards forward, and veering out from the bows a stream cable, with a small anchor and a spar lashed to it: thus riding, as at anchor, head to wind. He considered this mode much safer than scudding or lying-to; and in this situation, he said, his vessel seldom shipped any water.

"Mr. Owen, formerly master-attendant at Jamaica, recommended to schooners and other small vessels, when running before the wind in a gale, with a heavy sea following, to tow a hawser from the stern; as he had found, from experience, that it divided the waves, and prevented their breaking on board."—*Lieutenant Evans. Revision of Geographic Terms*, page 134.

IX.—LIGHTNING RODS AND CONDUCTORS.

"To protect a ship effectually from damage by lightning, it is essential that the conductor be as continuous and as direct as possible, from the highest point to the sea; that it be permanently fixed in the masts, throughout their whole extent, so as to admit of the motion of one portion of the mast upon another; and that, in case of the removal of any part of the mast, together with the conductor attached to it, either from accident or design, the remaining portion should still be perfect, and equal to the transmission of an electrical discharge into the sea. To fulfil these conditions, pieces of sheet copper, from one-sixteenth to one-eighth of an inch thick, varying from 1½ to 6 inches in breadth, and being about 2 feet long, according to the size of the masts, are inserted into the masts in two laminæ, one over the other, the butts or joints of the one being covered by the central portions of the other. The laminæ are riveted together at the butts, so as to form a long, elastic, and continuous line. The whole conductor is inserted under the edges of a neat groove, ploughed longitudinally in the aft side of the different masts, and secured in its

position by wrought copper nails, so as to present a fair surface. This metallic line then passes downward from the copper spindle at the mast-head, along the aft sides of the royal mast and top-gallant mast of large vessels, and is connected in its course with the copper about the sheave holes. A copper lining in the aft side of the cap, through which the topmast slides, now takes up the connexion, and continues it over the cap to the aft side of the topmast, and so on, as before, to the step of the mast; here it meets a thick wide copper lining, turned round the cap, under the heel of the mast, and resting on a similar layer of copper, which is fixed to the keelson; this last is connected with some of the keelson bolts, and with three perpendicular bolts of copper, of 2 inches diameter, which are driven into the main keel upon three transverse or horizontal bolts, brought into immediate contact with the copper expanded over the bottom. The laminæ of copper are turned over the respective mast-heads, and are secured about an inch or more down on the opposite side; the cap, which corresponds, is prepared in a somewhat similar way, the copper being continued from the lining in the aft part of the round hole, over the cap, into the fore part of the square one, where it is turned down and secured as before, so that, when the cap is in its place, the contact is complete. In this way we have, under all circumstances, a continuous metallic line from the highest points to the sea, which will transmit the electric matter directly through the keel, and emit it into the non-conducting fluid, where it becomes perfectly neutralized and harmless."—*Sir William Snow Harris*, F.R.S.

The subject has since been continued in the *Nautical Magazine* for the years 1835, 1837, 1838, 1839, 1840, 1851, and 1852.

X.—CLASSIFICATION OF THE CLOUDS, AS DEFINED IN THE NOMENCLATURE OF THE CELEBRATED METEOROLOGIST, MR. LUKE HOWARD.

Our naturalists on shore very frequently refer to the appearance of the sky according to the distinctions which have lately been established; but which, as yet, are very imperfectly understood by the generality of mariners, although sometimes introduced into the journals of the more informed. We have, beyond expectation, exceeded our intended limits in the present volume, but we cannot resist the wish to make this portion of knowledge generally understood by those who traverse the ocean, and who may, at least, be amused daily by comparing the atmosphere with the following explanation:—

The primary distinctions in the classification are,—1. The *Cirrus*, or *Curl Cloud*, generally the most elevated of all the clouds, and the first light cloud that forms in the sky after fine clear weather. It is very light and delicate in its appearance, in constant motion, generally curling or waving, like feathers or extended fibres. 2. The *Stratus*, or *Fall Cloud*, is an extended sheet cloud, sometimes small, shapeless, and undefined, like a creeping mist; and at other times covering a large portion of the earth; but it does not wet leaves or other substances. 3. The *Nimbus*, or *Rain Cloud*, an horizontal, heavy looking, and shapeless cloud, from which rain is falling. Whatever shape a cloud may have retained previous to rain falling from it, at the moment of its change from vapour to water it softens in appearance, and becomes a *Nimbus*. 4. The *Cumulus*, or *Stack Cloud*, which increases from below in dense convex and conical heaps, and is the grand prognostic and accompaniment of fair weather.

The Cirrus is often seen after a continuance of fine light weather, as a fine whitish line of cloud, stretched across the sky at a great height, the ends seeming lost in the horizon. This is often the first indication of a change to wet weather: to this line of Cirrus others are added laterally, and at times clouds of the same sort seem to proceed from the sides of the line, and are sent off in an oblique or transverse direction, so that the whole may have the appearance of net-work.

At other times the lines of Cirrus become denser, descend lower in the atmosphere, and by uniting or conjoining with others below produce rain. The line alluded to above is called the *Linear Cirrus*, and the transverse lines produce the *Reticulated* or *Curl Cloud*.

The *Comoid*, or *Hairy Cirrus*, commonly called *Mare's Tail*, is the proper Cirrus; it resembles, in appearance, a long lock of white hair, or a bunch of wool pulled out into fine pointed ends. The appearance of Cirrus in the atmosphere often indicates wind and rain; and when the fine tails have a constant direction toward any one point of the

compass, it has been frequently observed that the gale has sprung up from that quarter to which they previously pointed.

The *Stratus* comprehends fogs and all those creeping mists which, in summer evenings, fill the valleys, but disappear in the mornings. The best time for observing its formation is on a fine evening, after a hot summer's day; we shall then observe that, as the Cumuli of the day decrease, a white mist forms near the ground; this cloud, as the Cumuli evaporate, by degrees arrives at its density. In autumn it remains longer in the morning. In winter it often puts on a still denser appearance, and remains during the day, and even for many days successively.

The *Nimbus* always precedes a fall of snow, rain, or hail; and has received its name from a notion of the ancients, who distinguished between the *Imber*, or shower, and the *Nimbus*, or cloud, from which the rain comes.

The *Cumulus* (plural, *Cumuli*). The progressive formation of the Cumulus is seen in fine settled weather. If we then observe the sky soon after sunrise, we shall see small clouds here and there in the atmosphere, which appear to be the result of small gatherings, or concentrated parts of the evening mist, which, rising in the morning, grow into small masses of cloud, and the atmosphere becomes clear. As the sun rises, these clouds become larger, by adjacent ones coalescing, and at length a large cloud is formed, assuming a cumulated irregular hemispherical shape: this usually subsides in the evening as it formed in the morning, breaking into small masses, then fragments, and evaporating, when it is succeeded by the Stratus, to the formation of which it may have contributed. In fine weather these clouds form soon after sunrise, increase during the day, and subside with more regularity, and have a more hemispherical form, than in changeable weather. When well-formed Cumuli prevail for three or four days, the weather is settled. These Cumuli reflect a strong silvery light when opposed to the sun, like Alpine mountains covered with snow.

The *Secondary distinction of Clouds* partakes, in a mixed degree, of the preceding distinctions; hence we have the *Cirro-cumulus*, the *Cirro-stratus*, and the *Cumulo-stratus*.

The *Cirro-cumulus* (cirrus and cumulus) is an assemblage of *nubeculæ*, or small roundish clouds, either detached from, or in contact with, each other, and frequently reaching, to appearance, into the azure sky, commonly attended by an increased temperature, and found to accord with a rising barometer. The most striking feature is observable in summer, before or about the time of thunder-storms. The component nubeculæ are then very dense, round in form, and in closer apposition than usual. This kind of cloud is so commonly a forerunner of storms, that it has been assumed by some as a tempestuous prognostic. In rainy and variable weather another variety of this cloud appears, contrasted very strikingly with that above mentioned, being of a light fleecy texture, without any regular form in its nubeculæ. Sometimes the latter are so small as scarcely to be discernible, but the sky seems speckled with innumerable little white transparent spots.

The Cirro-cumulus of fair summer weather is of a medium nature, not so dense as the stormy variety, nor so light as the variable one. Its nubeculæ vary in size and proximity. In fine dry weather, with light gales of North and easterly winds, small detachments rapidly form and subside again, generally in an horizontal arrangement.

When the Cirro-cumulus prevails, we may anticipate an increase of temperature in summer; and in winter the breaking up of a frost, or warmer and wet weather. In the summer time, extensive beds of this cloud, viewed by moonlight, have a very beautiful appearance, which has been compared to a flock of sheep at rest. The Cirro-cumulus subsides either slowly, as if by evaporation, or changes into some other modification.

The *Cirro-stratus* (cirrus and stratus) or *Wane Cloud*, is composed of horizontal or slightly inclined masses of small clouds, attenuated toward a part or the whole of their exterior, bent downward or undulated, separate or in groups, and generally with a sinking barometer, indicating a decrease in temperature, with wind and rain or snow.

The Cirro-stratus is characterized by great horizontal extent in proportion to vertical breadth; so that when any other cloud begins to assume that form, it generally ends in Cirro-stratus. The Cirrus more commonly becomes a Cirro-stratus than any other cloud; the Cirro-cumulus next; and then the Cumulus. The Cirro-stratus, once formed, sometimes resumes the modification from which it originated, but more frequently it gradually

evaporates or conjoins with some other modification. It seldom remains long in one form, but seems to be constantly declining, and hence the term of *Wane Cloud*. It is sometimes composed of wavy bars or streaks, connected in the centre and confused, but the streaks more defined at the edges: this is common in variable weather in summer. The *Mackerel Sky*, as it is termed, is a variety of this; another variety consists of one long and plain streak, thick in the middle, and wasting away at its edges; and a third, consisting of small rows of little clouds, curved in a peculiar manner, and a sure indication of stormy weather: this is more or less regularly formed, and the irregular formation is often produced when a large Cumulus passes under a long line of Cirro-stratus, and is also a sign of stormy weather.

The last variety of Cirro-stratus is a large shallow veil of cloud, which extensively overspreads the sky, particularly in the evening and during the night, and through which the sun and moon appear dimly. It is in this cloud, that those peculiar refractions of light, of the sun and moon, called *haloes*, *mock suns*, &c., usually appear, and which is a tolerably certain prognostic of rain or snow. There are minor varieties, which may frequently be observed.

The Cirro-stratus usually terminates in forming an intimate union with some other cloud, to produce rain; but, at times, it evaporates or changes into some other modification.

The *Cumulo stratus* designates the Cirro-stratus blended with the Cumulus, and either appearing intermixed with the heaps of the latter, or super-adding a wide structure to its base. The Cumulo-stratus is most frequent during a mean or changeable state of the barometer, when the wind blows from the West, with occasional deviations from the North and South.

This cloud may be always regarded as a preliminary to the production of rain; and it frequently forms in the following manner:—the Cumulus, which, in common, passes along in the current of the wind, seems retarded in its progress, increases its density, spreads out laterally, and at length overhangs the base, in dark and irregular protuberances. The change to the Cumulo-stratus often takes place at once in all the Cumuli which are near to each other; and their bases uniting, the superstructure rises up with mountain-like or rocky summits. The change from Cumulus to Cumulo-stratus is often preceded by Cirro-stratus.

Cumulo-strata vary in appearance; those in which hail showers and thunder-storms form look extremely black before the change to rain, and have a menacing aspect, as they are seen coming slowly up with the wind. The Cumulo-stratus sometimes evaporates or changes again into Cumulus; but, in general, it ends in the Nimbus and fall of rain or snow: sometimes only one part forms a Nimbus, the other remaining a Cumulo-stratus.

General Remark on the *Nimbus*.—Any of the modifications above described may increase so much as to obscure the sky, without ending in rain; before which the peculiar characteristic of the rain-cloud may always be distinguished. In order to get a clear idea of its formation, you must observe a distant shower in profile, from its formation to its fall in rain. You may then observe the Cumulus first arrested, then the Cirro-stratus or Cirrus may appear to alight on its top; the change to Cumulo-stratus then goes on rapidly, and this cloud, increasing in density, assumes that black and threatening appearance known as an indication of rain: presently this blackness is changed to a gray obscurity, and this is the criterion of the actual formation of water, which now begins to fall, and constitutes the cloud a *Nimbus*, while a Cirriform crown of fibres extends from the upper part of the clouds, and small Cumuli enter into the lower part. After the shower has spent itself, the cloud resumes its title of Cumulo-stratus, and thence probably changes into a different modification; and if Cumulo-strati appear again, they indicate a return of rain.

Captain FitzRoy, in the Appendix to his Narrative of the Voyage of the *Beagle*, has given three very beautiful plates, exhibiting the form of clouds, in accordance with the preceding definitions. To his explanation, Captain FitzRoy adds, that the terms may be rendered more expressive by using the augmentative or diminutive terminations *onus* or *itus*, signifying in a greater or less degree, as Cirr*onus* (greater), cirr*itus* (lesser), &c.

The terms may be abbreviated in journalizing by using the initial letters of each word, as *Ci.* for Cirrus; *C.* Cumulus; *Ci. C.* Cirro-cumulus; *N.* Nimbus; *S.* Stratus; *Ci. S.* Cirro-stratus; *C. S.* Cumulo-stratus, &c.

XI.—MODE OF JOURNALIZING THE WIND AND WEATHER, AS PRESCRIBED BY CAPTAIN BEAUFORT, FOR H.M.S BEAGLE, IN 1831, AND SINCE ORDAINED, GENERALLY, FOR THE ROYAL NAVY.

An order, addressed to all captains and commanding officers of her Majesty's ships and vessels, dated Admiralty, December 28th, 1838, states, that the Lords Commissioners having had under consideration the general utility of recording, with clearness and precision, in the log-books, the actual state of the winds and weather, have thought fit to order, that henceforward, in every page of the log-book, two columns shall be introduced, wherein the force of the wind, and the appearance of the atmosphere, shall be registered every hour, according to the scheme annexed; a copy of which is to be pasted into each book, and painted on the back of every log-board, or log-slate; and two more columns to be given for the purpose of entering the heights of the barometer, or Simpiesometer, and thermometer, when such instruments may be on board.

Figures to denote the Force of the Wind.

A cypher, 0, denotes calm; figure 1, light air, just sufficient to give steerage way.

2, 3, and 4, *breezes* with which a well-conditioned man-of-war, under all sail, and clean full, would go in smooth water; 2, *light breeze*, from 1 to 2 knots; 3, *gentle breeze*, 3 to 4 knots; 4, *moderate breeze*, 5 to 6 knots.

5 to 9, *fresh breeze* to *strong gale*, in which the same ship could just carry close hauled; 5, *fresh breeze*, royals, &c.; 6, *strong breeze*, single reefs and top-gallant sails; 7, *moderate gale*, double reefs, jib, &c.; 8, *fresh gale*, triple reefs, courses, &c.; 9, *strong gale*, close reefs and courses.

10, *whole gale*, with which she could bear only close-reefed main-topsail, and reefed foresail; 11, *storm*, with which she would be reduced to storm staysails; 12, *hurricane*, to which she could show no canvas.

Letters to denote the State of the Weather.

b, blue sky, whether with clear or hazy atmosphere.

c, cloudy; that is, detached opening clouds.

d, drizzling rain; f. fog; ff, thick fog.

g, gloomy dark weather; h, hail; l, lightning.

m, misty or hazy, so as to interrupt the view.

o, overcast, the whole sky being covered with one impervious cloud; p, passing showers; q, squally; r, rain, continuous; s, snow; t, thunder.

u, ugly threatening appearance in the weather; v, visibility of distant objects, sky cloudy or not; w, wet dew.

● (a black spot) under any letter (or $\overline{\bullet}$) denotes an extraordinary degree.

Examples.

b, c, m, blue sky, with detached opening clouds, but hazy round the horizon.

g, v, gloomy dark weather, but distant objects remarkably visible.

q, p, d, l, t, very hard squalls and drizzling showers, with lightning and very heavy thunder.

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